DEPARTMENT OF VETERANS AFFAIRS
EXTERIOR BUILDING IMPROVEMENTS

TABLE OF CONTENTS
Section 00 01 10

SECTION 00 01 15
LIST OF DRAWING SHEETS

The drawings listed below accompanying this specification form a part of the contract.

Drawing No.	Title
	SITE PLANNING
C1	Site Plan
C2	Demolition Plan
C3	Plan and Profile
C4	Site Details
C5	Site Details
C6	Site Details

- - - E N D - - -

SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 GENERAL INTENTION

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for NRM Project 568-13-206, Exterior Building Improvements as required by drawings and specifications.

B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.

C. NOT USED

D. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the VA Project Manager/COTR in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the VA Project Manager/COTR.

E. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.

F. Prior to commencing work, general contractor shall provide proof that a OSHA certified “competent person” (CP) (29 CFR 1926.20(b)(2) who has the 30-hour OSHA certification for Construction Safety will maintain a presence at the work site whenever the general or subcontractors are present.

G. Training:

1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and /or other relevant competency training, as determined by VA CP with input from the ICRA team. Final approval of the equivalent training in lieu of

the 10-Hour OSHA certification will be made by the Engineering Program Manager.

2. Submit training records of all such employees for approval before the start of work.

1.2 STATEMENT OF BID ITEM(S)

A. ITEM I, BASE BID

Building 12: Removal of lead paint on exterior fasciae, dormers and roof overhang surfaces of building 12, and re-panting of these surfaces.

Building 11: Abatement of existing exterior lead paint cedar shingles on the building 11 ramp and re-painting of these surfaces, lead paint abatement of windows and re-painting of windows, re-glazing of windows and replacement of existing storm windows.

Building 1: Concrete entry work in front of Building 1 which includes re-grading, concrete replacement, electrical and earthwork. Work includes abatement of lead paint on exterior surfaces and re-painting of these surfaces. The work also includes abatement of lead paint window trim and repainting of trim, re-glazing of existing windows and replacement of existing storm windows.

B. ITEM II, DEDUCT ALTERNATE 1

All work in Item I Base Bid minus all work associated with Building 11.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

Contractor is responsible for printing all drawings and specifications from the FedBiz Website. The VA will not provide hard copy plans and specifications.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.

2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor’s employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.

2. For working outside the “regular hours” as defined in the contract, The General Contractor shall give 3 days notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.

3. No photography of VA premises is allowed without written permission of the Contracting Officer or VA Project Manager/COTR.

4. VA reserves the right to close down or shut down the project site and order General Contractor’s employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. The General Contractor shall provide duplicate keys and lock combinations to the VA Project Manager/COTR for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

Document Control:

1. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.

2. All paper waste or electronic media such as CD’s and diskettes shall be shredded and destroyed in a manner acceptable to the VA.

E. Motor Vehicle Restrictions, Parking:

All contractor vehicles shall be parked in general parking areas. At no time shall there be a vehicle parked in patient/visitor only

parking, or medical staff only parking except for immediate loading and unloading. No parking is permitted in fire department locations needed for access.

1.5 FIRE SAFETY

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):

E84-2009.....Surface Burning Characteristics of Building Materials

2. National Fire Protection Association (NFPA):

10-2010.....Standard for Portable Fire Extinguishers

30-2008.....Flammable and Combustible Liquids Code

51B-2009.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2011.....National Electrical Code

241-2009.....Standard for Safeguarding Construction, Alteration, and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

29 CFR 1926.....Safety and Health Regulations for Construction

B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to VA Project Manager/COTR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor’s competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the VA Project Manager/COTR that individuals have undergone contractor’s safety briefing.

C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).

E. Not used

F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.

G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with VA Project Manager/COTR.

H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to VA Project Manager/COTR.

I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

M. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with VA Project Manager/COTR and Fire Department. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the VA Project Manager/COTR.

N. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with VA Project Manager/COTR.

O. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with VA Project Manager/COTR. VA Project Manager/COTR at least 8 hours in advance.

P. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas daily. Coordinate with, and report findings and corrective actions daily to VA Project Manager.

Q. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.

R. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

S. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.

T. If required, submit documentation to the VA Project Manager/COTR that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.6 OPERATIONS AND STORAGE AREAS

A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the VA Project Manager/COTR. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer/VA Project Manager/COTR and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work,

vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

(FAR 52.236-10)

SPEC WRITER NOTES:

D. Working space and space available for storing materials shall be as determined by the VA Project Manager/COTR.

E. Workmen are subject to rules of Medical Center applicable to their conduct.

F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by VA Project Manager/COTR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.

2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. It is the contractor’s responsibility to receive delivered materials; VA staff cannot receive items for the contractor. Provide unobstructed access to Medical Center areas required to remain in operation.

3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.

G. NOT USED

H. NOT USED

I. Construction Fence: Before construction operations begin, Contractor shall provide a construction safety fence as directed by Resident Engineer.

J. NOT USED

K. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by VA Project Manager/COTR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of VA Project Manager/COTR. Electrical work shall be accomplished with all affected circuits or equipment de-energized.

2. Contractor shall submit a request to interrupt any such services to VA Project Manager/COTR, in writing, 48 hours in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.

3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.

4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the VA Project Manager/COTR.

5. In case of a contract construction emergency, service will be interrupted on approval of VA Project Manager/COTR. Such approval will be confirmed in writing as soon as practical.

6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam,

payment of such fee shall be the responsibility of the Government and not the Contractor.

L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

M. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles.

2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the VA Project Manager/COTR.

N. Coordinate the work for this contract with other construction operations as directed by VA Project Manager/COTR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

1.7 ALTERATIONS

A. Protection: Provide the following protective measures:

1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.

2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.

3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 INFECTION PREVENTION MEASURES

A. Implement the requirements of VAMC’s Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.

B. Establish and maintain a dust control program as part of the contractor’s infection preventive measures in accordance with the guidelines provided by ICRA Group. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to VA Project Manager/COTR for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

   1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

C. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:

   1. The VA Project Manager/COTR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.

   2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.

D. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.

   1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by VA Project

Manager/COTR. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.

2. Do not perform dust producing tasks within occupied areas without the approval of the VA Project Manager/COTR. For construction in any areas that will remain jointly occupied by the medical Center and Contractor’s workers, the Contractor shall:

   a. Provide dust proof one-hour (or two-hour as required) temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, to allow worker access. Maintain negative air at all times. Only with approval from the Engineering Program Manager, will a fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard.

   b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.

   c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24” x 36”), shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.

   d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday or as needed during the work day. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are

created. Transport these outside the construction area in containers with tightly fitting lids.

e. The contractor shall not haul debris through patient-care areas without prior approval of the VA Project Manager/COTR and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.

g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

E. NOT USED

1.9 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:

1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or

branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

1.11 RESTORATION

A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the VA Project Manager/COTR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the VA Project Manager/COTR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.

D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.12 NOT USED

1.13 NOT USED

1.14 NOT

1.15 AS-BUILT DRAWINGS

A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.

B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the VA Project Manager/COTR's review, as often as requested.

C. Contractor shall deliver two approved completed sets of as-built drawings to the VA Project Manager/COTR within 15 calendar days after each completed phase and after the acceptance of the project by the VA Project Manager/COTR.

D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.16 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the VA Project Manager/COTR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.

1.17 NOT USED

1.18 AVAILABILITY AND USE OF UTILITY SERVICES

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge.

B. The Contractor, at Contractor's expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

C. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:

1. Obtain heat by connecting to Medical Center heating distribution system.

   a. Steam is available at no cost to Contractor.

E. Electricity (for Construction and Testing): Furnish all temporary electric services.

1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.

F. Water (for Construction and Testing): Furnish temporary water service.

1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection. Water is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at VA Project Manager/COTR's discretion) of use of water from Medical Center's system.

G. Steam: Furnish steam system for testing required in various sections of specifications.

1. Obtain steam for testing by connecting to the Medical Center steam distribution system. Steam is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at VA Project Manager/COTR's discretion), of use of steam from the Medical Center's system.

1.19 NOT USED

1.20 NOT USED

1.21 SAFETY AND CONSTRUCTION SIGN(S)

Provide a Safety Sign(s) where directed by VA Project Manager/COTR, maintain sign(s) and remove it when directed by VA Project Manager/COTR.

1.22 HISTORIC PRESERVATION

Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the VA Project Manager/COTR verbally, and then with a written follow up.

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+Medical Center Requirements

Section 01011

1.0 General Intention: This document pertains to station safety, health, and environmental policies for construction projects performed at the VA Black Hills Health Care System. Safety and health concerns are taken seriously at this facility. Both our staff and yours are expected to strictly adhere to the regulations and requirements. This is exceedingly important, since we must be primarily concerned for the safety of our patients. In this regard, OSHA Standards may protect worker safety and health, but they have minimal benefit for protecting the safety and health of our patients, due primarily to their differing medical conditions. Review this information as orientation with your personnel performing work on site. In addition, construction can have significant impacts to the environment. It is the policy of this organization to minimize impacts in accordance with the facility's integrated Green Environmental Systems (GEMS). Where the requirements as outlined in this and Section 01010 are differing, the more stringent shall apply.

2.0 Requirements:

A. Security:

1. Secure all construction areas, especially mechanical and electrical rooms against entry of unauthorized individuals including patients.

2. Notify the Contracting Officer's Technical Representative (COTR) for permission to work after hours and weekends. Standard work hours for the medical center are Monday–Friday, 7:00 a.m. to 4:30 p.m.

3. The VA will issue ID tags to contractor personnel. All contractor personnel are required to wear the VA provided ID at all times while working on government property. The Contractor will submit ID requests for each employee (including subcontractor employees) using the request form on attachment A.

B. Key Security:

1. Only a limited number of keys will be issued to the contractor. Key requests shall be made using the request form on attachment B.

2. If the Contractor loses a key, a charge of $30 will be billed for a replacement key.

3. Ensure all doors leading to and from construction are either monitored or locked to prevent access to the area from unauthorized persons.

C. Contractor General Safety Program and Training Requirements:

1. The Contractor shall appoint a "Competent Person" (CP) for the project. The CP will have primary responsibility for construction safety, OSHA compliance, and adherence to the Contractor's safety program. The Contractor shall provide for approval, as part of the submittal process, the name of the CP and documentation that the individual has had the necessary training, experience, and has the authority to carry out their responsibilities with respect to safety and health during construction activities. Evidence of training shall include completion of OSHA approved courses or other construction safety training consistent with the scope of the project.

2. The Contractor shall also provide for approval, as part of the submittal process, evidence of a company safety policy that includes, as a minimum, the following components: a) Safety is the first priority and will not be compromised, b) PPE is provided for employees, and the employees are trained in its use, c) Details of regularly scheduled safety training for jobs site employees in regards to OSHA requirements, construction related impacts, and Life Safety Code requirements. This may be accomplished through documented "tool box talks", or other similar methods.

3. The Contractors CP and primary workers will be required to view a VA provided video tape, "Playing It Safe", approximate viewing time 15 minutes. The video identifies concerns regarding patients safety, privacy, and infection control; and introduces Contractor's workers to the unique safeguards required when working in a hospital environment.

4. Adhere to the following:

   - Follow all federal, state and local safety and health regulations.

   - Maintain safety in the construction site/area in accordance with the provisions of the contract that includes the Occupational Safety and Health Administration (OSHA) Regulations; National Electrical Codes; National Fire Protection Association (NFPA) 70, National Electric Code; and NFPA 101, Life Safety Code. Work in a safe manner and take all proper precautions while performing your work. Extra precautions shall be taken when working around persons occupying the building during construction.

   - Provide Personal Protective Equipment (PPE) for your employees.

   - Post appropriate signs in specific hazardous areas.

   - Keep tools, ladders, etc., away from patients to prevent injuries.

D. Safety Inspections:

1. The VA professional Occupational Safety and Health staff at this facility will perform safety inspections of all contract operations. Written reports of unsafe practices or conditions will be reported to the COTR and Contracting Officer for immediate attention and resolution.

2. The Contractor's superintendent/CP is required to monitor work on a daily basis, including surveillance related to health and safety. The daily inspections are to be documented via the check list included on the back of the Daily Log form (attachment C). Completed Daily Logs should be provided to the COTR at the end of each shift, and no later than the next working day.

E. Fire Alarms:

3. The fire alarm system connects all buildings at this facility, and is activated by various heat, duct, manual pull stations and smoke sensors. Manual pull stations are provided at each entrance. Survey the area in which you are working to locate the manual pull stations.

4. In the event of a fire alarm sounding, you are to remain in your area, unless medical center personnel (Safety, Nursing or Engineering) instruct otherwise, or

unless a fire situation is in your area, in which case you should immediately evacuate.

5. Any work involving the fire protection systems requires written permission to proceed from the COTR. *Do not tamper with or otherwise disturb any fire alarm system components without prior written permission. To do so without written permission will result in an adverse action.*

F. Hazardous Materials:

1. Many of the operations you are scheduled to perform may involve the use of hazardous materials. Prior to locating hazardous materials on site, submit all Material Safety Data Sheets (MSDS) through the COTR for evaluation by the facility Safety Officer.

2. Storage of hazardous materials within buildings shall be minimal with only enough on hand to perform daily work tasks. Flammable materials must either be removed from buildings at the end of the work shift or stored in approved flammable storage containers.

3. Care must be taken to ensure adequate ventilation to remove vapors of hazardous materials in use. Many of the patients being cared for in the facility are susceptible to environmental contaminants, even when odors seem minimal. Isolate those areas where vapors are produced, and ventilate to the most extent possible to reduce the number of complaints.

G. Airborne Dust Control During Construction:

1. Generation of dust is of major concern within staff, and especially in patient occupied buildings. Where operations involve the generation of dust, all efforts shall be directed at reducing airborne generated dust to the lowest level feasible. This may be accomplished by a number of methods. These include misting the area with water, or use of tools attached to high efficiency particulate air (HEPA) filtering vacuums. Where large amounts of materials may be disturbed, resulting in airborne dust, establishment of full ceiling-to-floor barriers shall be required.

2. Classification of Jobs:

   a. CLASS I - Includes, but is not limited to, minor disturbances involving plumbing, electrical, carpentry, ductwork and minor aesthetic improvements.

   b. CLASS II - (projects require barrier precautions) - Includes, but is not limited to, construction of new walls, construction of new rooms, major utility changes, major equipment installation, demolition of wallboards, plaster, ceramic tiles or ceiling and floor tiles, removal of windows, removal of casework, etc.

H. Class I Procedures:

1. Mist (with water) work surfaces to control dust while cutting. Alternatively a high efficiency particulate air vacuum (HEPA) can be used by positioning the vacuum next to the equipment at the use site.

2. Tape doors for activities that produce large amounts of dust, and block off and seal air vents.

3. Cover holes/openings (penetrations), in walls, ceiling, floors or door that cannot be patched or fixed within 4 hours. Only approved fire-rated materials will be used to fill holes in fire/smoke walls.

4. Comply with the OSHA regulations regarding noise and vapor containment.

5. Cleanup and disposal: Construction waste must be contained before transport using plastic bags and/or covered transport receptacle and/or cart and tape covering.

6. Wet mop and/or HEPA vacuum before leaving work area.

7. Place dust mats at entrance and exit of work area, and clean or change daily to prevent tracking of dust into occupied areas.

8. After work completion, remove covering from air vents.

I. Class II (Post Construction Warning Signs):

1. Same procedures as Class I - however, use of a HEPA vacuum is mandatory.

2. Construct all dust barriers before construction begins per the following instructions: For single rooms, seal door/frame with tape and plastic. The sheet should be divided vertically with a knife. Flaps should be taped on either side of the single sheet to create a flapped entrance.

3. For larger areas, install an airtight (fire retardant) barrier that extends from floor to ceiling, or seal to prevent dust and debris from escaping. Seal all seams with duct tape. Install barrier partitions to stop movement of air and debris penetrating ceiling envelopes, chases and/or ceiling spaces. Construct entrance with a double flap of plastic to prevent escape of debris; or, if elevator shafts or stairways are within the field of construction, install solid barriers.

J. Contact with Asbestos Containing Materials (ACM):

1. Due to the age of buildings, many contain asbestos containing materials (ACM). Primary ACM uses in the medical center includes floor tile, mastic, piping and HVAC insulation. The medical center has performed a comprehensive asbestos survey and has identified accessible ACM. Some areas contain damaged asbestos and should not be accessed without prior abatement.

2. The most common type of ACM insulation you may encounter includes thermal system insulation (TSI) and floor tile. ACM TSI is generally covered with a cloth wrap or lagging, and the asbestos substrate generally appear white in color. *Do not sand, drill, gouge or otherwise disturb this type of insulation.* Contractors disturbing or releasing asbestos containing materials will be liable for all damages and cleanup costs.

3. Where disturbance of asbestos is likely, it has been addressed in the contract for removal. If contact with the presence of asbestos is presented, stop all work in the immediate area and immediately contact the COTR or Safety Officer to make necessary arrangements for removal.

4. In some areas, asbestos insulation has been identified on elbows, between fiberglass piping insulation, as patching materials among the fiberglass insulation. Fiberglass insulation used in this facility is usually yellow or pink in color, wrapped either by cloth or paper lagging.

5. A complete assessment of asbestos materials and conditions are available for viewing by contacting the COTR. Prior to performing work above any ceiling or starting in a new area, consult with the COTR concerning existing conditions of ACM.

6. Some of the areas in the facility are identified as restricted areas due to condition of ACM. These are readily labeled. *Do not enter these areas* unless first contacting the COTR. Entry requirements to these areas are awareness of the hazards, proper protective clothing (coveralls and respirators) and personal monitoring in accordance with OSHA requirements.

K. Environmental Protection:

1. It may help you to be aware of the seriousness that the environmental protection requirements of each contract are regarded. Adherence to these requirements is subject to continuing scrutiny from the community and backed by severe penalties, such as fines and incarceration. These environmental requirements will be strictly enforced. Contractors are required to abide by all Federal, State, and Local environmental regulations.

2. *No* hazardous materials will be disposed of on Government property. Haul all waste off-site or dispose in contractor owned and operated waste removal containers.

3. Forward a copy of all waste manifests for special or hazardous wastes to the COTR. Environmental requirements will be strictly enforced.

L. Permit Required Confined Spaces:

1. Contractors performing work on this facility shall follow all requirements outlined in OSHA Standards for working in confined spaces. There are numerous permit required confined spaces on this facility. These spaces have been identified. Some spaces have been posted, but the majority have not due to their configuration. A complete listing of these areas is located in the Fire Department.

2. Confined spaces are areas that are large enough to be entered, have limited egress/exit potential and are not designed for permanent human occupancy. If you encounter any space that meets this definition, and if it is a suspected confined space, contact the COTR.

3. Contractors performing work in confined spaces are responsible for compliance with all applicable standards and regulations.

M. Housekeeping:

1. Protect patients and VA personnel in occupied areas from the hazards of dust, noise, construction debris and material associated with a construction environment. Keep work area clear, clean and free of loose debris, construction materials and partially installed work that would create a safety hazard or interfere with VA personnel duties and traffic.

2. Wet mop occupied areas clean and remove any accumulation of dust/debris from cutting or drilling from any surface at the end of each workday.

3. Make every effort to keep dust and noise to a minimum at all times. Take special precautions to protect VA equipment from damage including excessive dust.

4. Maintain clear access to mechanical, electrical devices, equipment and main corridors. This will ensure access to existing systems in the event of an emergency.

5. Clean area of all construction debris and dust upon completion of demolition and/or renovation.

6. During construction operations, keep existing finishes protected from damage. Cover and protect all carpets during construction. Any carpets or surfaces damaged as a result of construction activities will be replaced at the contractor expense.

N. Hot Work Permits:

1. Any hot work operations including cutting, welding, thermal welding, brazing, soldering, grinding, thermal spraying, thawing pipes or any other similar activity, require a Hot Work Permit to be obtained by the Contractor from the Fire Department. The Contractor is responsible for conforming to all Medical Center regulations, policies and procedures concerning Hot Work Permits as outlined below:

    a. Prior to the performance of hot work in patient-occupied buildings, request a Hot Work Permit from the Fire Department.

    b. The Fire Department will inspect the area and ensure that the requirements of NFPA 241 and OSHA standards have been satisfied. The Hot Work Permit will be granted and must be posted in the immediate area of the work.

    c. The Hot Work Permit will apply only to the location identified on the permit. If additional areas involve hot work, additional permits must be requested.

    d. Upon completion of all hot work, notify the Fire Department to perform a re-inspection of the area.

2. Do not use any of the extinguishers in the medical center for standby purpose while conducting hot work. Contractors are required to supply their own Class ABC extinguishers. Medical center extinguishers are only to be used in the event of a fire.

O. Emergency Medical Services: Emergency medical services for stabilization purposes are available for contractors at this facility. For medical emergencies, dial 6911 when inside any building. Report the nature of the emergency and location. The operator will dispatch in-house personnel or coordinate an outside emergency assistance based on the nature of the emergency.

P. Use of Government-Owned Material and Equipment: Use of Government-owned material and equipment is *prohibited*.

Q. Superintendent Communications: At all times during the performance of this contract, the Contractors Superintendent is to be available by cellular phone. At the beginning of the contract and prior to beginning any construction, supply the COTR with the telephone number for the Superintendent.

R. Parking: Contractor employees shall be assigned a parking area during the preconstruction meeting.

S. Traffic:

1. Traffic hazards are minimal at this facility. Drivers should be particularly concerned with pedestrian traffic.
2. Seat belt use is mandatory on the station.
3. Federal police officers maintain a 24-hour patrol of the area.
4. Speed limits are to be observed, and are strictly enforced.

T. Contractor's Trailers: Contractor's trailers shall be located at the area assigned. All utility connections to the trailer shall be installed at the contractor expense. Trailer removal is required upon completion of the contract, unless approved by the COTR to leave in place.

U. Smoking: No smoking is permitted in buildings or around hazardous areas. Any smoking inside a government building is subject to a fine without warning.

V. Lock out/tag out: Contractors performing work on equipment and systems are responsible for compliance with the facilities lock out/tag out policies.

W. Road Closures: For any work requiring closure of a road or parking lot, a request for closure shall be made in writing at least 5 days in advance for approval by the COTR and Fire Department.

SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.

1-2. For the purposes of this contract, samples, test reports, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.

1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:

A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.

1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.

1-5. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

1-6. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.

A. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
   1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
   2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
   3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.

B. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.

C. Approved samples will be kept on file by the Resident Engineer at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.

D. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.

1. For each drawing required, submit one legible photographic paper or vellum reproducible.
2. Reproducible shall be full size.
3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Project Engineer under one cover.

1-7. Samples shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

Department of Veterans Affairs Project Engineer

500 North 5th Street

Hot Springs, SD 57747

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SECTION 01 33 24
SUBMITTAL REGISTER

1.0 General Intention: This document pertains to the submittals pertaining to the submittals section. This section lists by item the submittals that need to be submitted and what types of submittals that are required. This is also used as a planning tool for timely submittals.

2.0 Requirements:

A. Items:

1. **This submittal log will be filled out by the designer by item for each submittal. This will list in sequence all parts and components of every section in which a submittal is required.**

2. **If each item of an assembly is to be certified by submittal together then each part of the assembly does not need to be listed separately.**

3. **This submittal log may be added to during the course of the project.**

SUBMITTAL REGISTER

CONTRACT NO:

TITLE AND LOCATION:
Hot Springs VA

CONTRACTOR:

PROJECT NUMBER:
FY13 Wireless Project

				TYPE OF SUBMITTAL									CLASSIFICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
ITEM NO.	SPEC SECTION NO.	SPEC PARA. NO.	DESCRIPTION OF ITEM SUBMITTED	DATA SHEETS	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFO ONLY	GOVT APPROVED	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERNMENT	CODE	DATE	REMARKS
1	**010000**	1.4.A	Security Plan						X					X										
2	**010000**	1.4.C.1	Keys								X		X											
3	**010000**	1.5.B	Fire Safety Plan						X					X										
4	**010000**	1.6.G	Phasing Plan						X					X										
5	**010000**	1.13	Land Surveyor Certification							X				X										
6	**010000**	1.15	As-Built Drawings									X		X										
7	**010100**	1.2.B.1	Safety Plan							X				X										
8	**010100**	1.2.B.2	Traffic Control Plan							X				X										
9	**010100**	1.2.B.3	OSHA Certification							X				X										
10	**010100**	2.1.A.3	ID tags copy								X			X										

SUBMITTAL REGISTER																						CONTRACT NO:		
TITLE AND LOCATION: Hot Springs VA																						CONTRACTOR:		PROJECT NUMBER: FY13 Wireless Project
ITEM NO.	SPEC SECTION NO.	SPEC PARA. NO.	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL										CLASSI-FICATION		REVIEWER	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
				DATA SHEETS	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS		INFO ONLY	GOVT APPROVED		SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
11	**010100**	2.1.C.1	Competent Person Appointment					X							X										
12	**010100**	2.1.C.2	Company Safety Policy					X							X										
13	**010100**	2.1.F.1	Material Safety Data Sheets	X											X										
14	015719	1.4.A.1	Environmental Protection Plan							X					X										
15	017419	1.5	Demolition Debris Management Plan							X					X										
16	033053	1.5.B	Concrete Mix Design	X											X										
17	033053	1.5.C	Reinforcing Steel	X											X										
18	033053	1.5	Admixtures and Curing Compound	X											X										
19	033713	1.5.B	Shotcrete Design Mix	X											X										

SUBMITTAL REGISTER		CONTRACT NO:
TITLE AND LOCATION: Hot Springs VA	CONTRACTOR:	PROJECT NUMBER: FY13 Wireless Project

				TYPE OF SUBMITTAL									CLASSIFICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		
ITEM NO.	SPEC SECTION NO.	SPEC PARA. NO.	DESCRIPTION OF ITEM SUBMITTED	DATA SHEETS	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFO ONLY	GOVT APPROVED	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	REMARKS
20	033713	1.5.C	Aggregate Gradation	X										X										
21	033713	1.5.D	Shotcrete Qualification	X										X										
22	040513	1.4.B	Mortar Design Mix	X										X										
23	040513	1.4.C	Mortar Color Admixture	X										X										
24	040513	1.4.D	Stone/Mortar Mockup								X			X										
25	312011	1.6.B	Rock Excavation Report						X					X										
26	312011	1.6.C	Aggregate Base Course	X										X										
27	312011	1.6.D	Type I Backfill	X										X										
28	312323.33	1.5.B	Flowable Fill Mix Design	X										X										

SUBMITTAL REGISTER																		CONTRACT NO:						
TITLE AND LOCATION: Hot Springs VA																		CONTRACTOR:						PROJECT NUMBER: FY13 Wireless Project
ITEM NO.	SPEC SECTION NO.	SPEC PARA. NO.	DESCRIPTION OF ITEM SUBMITTED	TYPE OF SUBMITTAL									CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVERNMENT ACTION		REMARKS
				DATA SHEETS	DRAWINGS	INSTRUCTIONS	SCHEDULES	STATEMENTS	REPORTS	CERTIFICATES	SAMPLES	RECORDS	INFO ONLY	GOVT APPROVED	REVIEWER	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	CODE	DATE	SUBMIT TO GOVERN-MENT	CODE	DATE	
29	320523	1.5.B	Concrete Materials	X										X										
30	329000	1.7	Seed/Fertilizer	X										X										
31																								

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to – GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.

B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street N.W, (sixth floor)
Washington, DC 20001
Telephone Numbers: (202) 632-5249 or (202) 632-5178
Between 9:00 AM - 3:00 PM

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA Aluminum Association Inc.
http://www.aluminum.org

AABC Associated Air Balance Council
http://www.aabchq.com

AAMA American Architectural Manufacturer's Association
http://www.aamanet.org

AAN American Nursery and Landscape Association
http://www.anla.org

AASHTO American Association of State Highway and Transportation Officials
http://www.aashto.org

AATCC American Association of Textile Chemists and Colorists
http://www.aatcc.org

ACGIH American Conference of Governmental Industrial Hygienists
http://www.acgih.org

ACI American Concrete Institute
http://www.aci-int.net

ACPA American Concrete Pipe Association
http://www.concrete-pipe.org

ACPPA American Concrete Pressure Pipe Association
http://www.acppa.org

ADC Air Diffusion Council
http://flexibleduct.org

AGA American Gas Association
http://www.aga.org

AGC Associated General Contractors of America
http://www.agc.org

AGMA	American Gear Manufacturers Association, Inc. http://www.agma.org
AHAM	Association of Home Appliance Manufacturers http://www.aham.org
AISC	American Institute of Steel Construction http://www.aisc.org
AISI	American Iron and Steel Institute http://www.steel.org
AITC	American Institute of Timber Construction http://www.aitc-glulam.org
AMCA	Air Movement and Control Association, Inc. http://www.amca.org
ANLA	American Nursery & Landscape Association http://www.anla.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
APA	The Engineered Wood Association http://www.apawood.org
ARI	Air-Conditioning and Refrigeration Institute http://www.ari.org
ASAE	American Society of Agricultural Engineers http://www.asae.org
ASCE	American Society of Civil Engineers http://www.asce.org
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org

ASTM	American Society for Testing and Materials http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org
AWS	American Welding Society http://www.aws.org
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	Brick Institute of America http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CI	The Chlorine Institute, Inc. http://www.chlorineinstitute.org
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org
CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org
CLFMI	Chain Link Fence Manufacturers Institute http://www.chainlinkinfo.org
CPMB	Concrete Plant Manufacturers Bureau http://www.cpmb.org
CRA	California Redwood Association http://www.calredwood.org
CRSI	Concrete Reinforcing Steel Institute http://www.crsi.org

CTI	Cooling Technology Institute http://www.cti.org
DHI	Door and Hardware Institute http://www.dhi.org
EGSA	Electrical Generating Systems Association http://www.egsa.org
EEI	Edison Electric Institute http://www.eei.org
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.et1.com
FAA	Federal Aviation Administration http://www.faa.gov
FCC	Federal Communications Commission http://www.fcc.gov
FPS	The Forest Products Society http://www.forestprod.org
GANA	Glass Association of North America http://www.cssinfo.com/info/gana.html/
FM	Factory Mutual Insurance http://www.fmglobal.com
GA	Gypsum Association http://www.gypsum.org
GSA	General Services Administration http://www.gsa.gov
HI	Hydraulic Institute http://www.pumps.org
HPVA	Hardwood Plywood & Veneer Association http://www.hpva.org

ICBO International Conference of Building Officials
http://www.icbo.org

ICEA Insulated Cable Engineers Association Inc.
http://www.icea.net

\ICAC Institute of Clean Air Companies
http://www.icac.com

IEEE Institute of Electrical and Electronics Engineers
http://www.ieee.org\

IMSA International Municipal Signal Association
http://www.imsasafety.org

IPCEA Insulated Power Cable Engineers Association

NBMA Metal Buildings Manufacturers Association
http://www.mbma.com

MSS Manufacturers Standardization Society of the Valve and Fittings Industry Inc.
http://www.mss-hq.com

NAAMM National Association of Architectural Metal Manufacturers
http://www.naamm.org

NAPHCC Plumbing-Heating-Cooling Contractors Association
http://www.phccweb.org.org

NBS National Bureau of Standards
See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors
http://www.nationboard.org

NEC National Electric Code
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
http://www.nema.org

NFPA National Fire Protection Association
http://www.nfpa.org

NHLA National Hardwood Lumber Association
http://www.natlhardwood.org

NIH National Institute of Health
http://www.nih.gov

NIST National Institute of Standards and Technology
http://www.nist.gov

NLMA Northeastern Lumber Manufacturers Association, Inc.
http://www.nelma.org

NPA National Particleboard Association
18928 Premiere Court
Gaithersburg, MD 20879
(301) 670-0604

NSF National Sanitation Foundation
http://www.nsf.org

NWWDA Window and Door Manufacturers Association
http://www.nwwda.org

OSHA Occupational Safety and Health Administration
Department of Labor
http://www.osha.gov

PCA Portland Cement Association
http://www.portcement.org

PCI Precast Prestressed Concrete Institute
http://www.pci.org

PPI The Plastic Pipe Institute
http://www.plasticpipe.org

PEI Porcelain Enamel Institute, Inc.
http://www.porcelainenamel.com

PTI Post-Tensioning Institute
http://www.post-tensioning.org

RFCI The Resilient Floor Covering Institute
http://www.rfci.com

RIS Redwood Inspection Service
See - CRA

RMA Rubber Manufacturers Association, Inc.
http://www.rma.org

SCMA Southern Cypress Manufacturers Association
http://www.cypressinfo.org

SDI Steel Door Institute
http://www.steeldoor.org

IGMA Insulating Glass Manufacturers Alliance
http://www.igmaonline.org

SJI Steel Joist Institute
http://www.steeljoist.org

SMACNA Sheet Metal and Air-Conditioning Contractors
National Association, Inc.
http://www.smacna.org

SSPC The Society for Protective Coatings
http://www.sspc.org

STI Steel Tank Institute
http://www.steeltank.com

SWI Steel Window Institute
http://www.steelwindows.com

TCA Tile Council of America, Inc.
http://www.tileusa.com

TEMA Tubular Exchange Manufacturers Association
http://www.tema.org

TPI Truss Plate Institute, Inc.
583 D'Onofrio Drive; Suite 200
Madison, WI 53719
(608) 833-5900

UBC The Uniform Building Code
See ICBO

UL Underwriters' Laboratories Incorporated
http://www.ul.com

ULC Underwriters' Laboratories of Canada
http://www.ulc.ca

WCLIB West Coast Lumber Inspection Bureau
6980 SW Varns Road, P.O. Box 23145
Portland, OR 97223
(503) 639-0651

WRCLA Western Red Cedar Lumber Association
P.O. Box 120786
New Brighton, MN 55112
(612) 633-4334

WWPA Western Wood Products Association
http://www.wwpa.org

- - - E N D - - -

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by Department of Veterans.

1.2 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates

T96-02 (R2006).....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-10.....Standard Method of Test for Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

T191-02(R2006).....Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method

C. American Concrete Institute (ACI):

506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete

D. American Society for Testing and Materials (ASTM):

A325-10.....Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

A370-12.....Standard Test Methods and Definitions for Mechanical Testing of Steel Products

A416/A416M-10.....Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

A490-12.....Standard Specification for Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength

C31/C31M-10.....Standard Practice for Making and Curing Concrete Test Specimens in the Field

C33/C33M-11a.....Standard Specification for Concrete Aggregates

C39/C39M-12.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

C109/C109M-11b.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

C136-06.....Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

C138/C138M-10b.....Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

C140-12.....Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

C143/C143M-10a.....Standard Test Method for Slump of Hydraulic Cement Concrete

C172/C172M-10.....Standard Practice for Sampling Freshly Mixed Concrete

C173/C173M-10b.....Standard Test Method for Air Content of freshly Mixed Concrete by the Volumetric Method

C330/C330M-09.....Standard Specification for Lightweight Aggregates for Structural Concrete

C567/C567M-11.....Standard Test Method for Density Structural Lightweight Concrete

C780-11.....Standard Test Method for Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

C1019-11.....Standard Test Method for Sampling and Testing Grout

C1064/C1064M-11.....Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete

C1077-11c.....Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

C1314-11a.....Standard Test Method for Compressive Strength of Masonry Prisms

D422-63(2007).....Standard Test Method for Particle-Size Analysis of Soils

D698-07e1.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
D1140-00(2006).....Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve
D1143/D1143M-07e1.....Standard Test Methods for Deep Foundations Under Static Axial Compressive Load
D1188-07e1.....Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
D1556-07.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
D1557-09.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft lbf/ft3 (2,700 KNm/m3))
D2166-06.....Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
D2167-08).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
D2216-10.....Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D2974-07a.....Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
D3666-11.....Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
D3740-11.....Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction
D6938-10.....Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
E94-04(2010).....Standard Guide for Radiographic Examination
E164-08.....Standard Practice for Contact Ultrasonic Testing of Weldments
E329-11c.....Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
E543-09.....Standard Specification for Agencies Performing Non-Destructive Testing

E605-93(R2011).....Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material (SFRM) Applied to Structural Members
E709-08.....Standard Guide for Magnetic Particle Examination
E1155-96(R2008).....Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):
D1.D1.1M-10.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory’s scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the “Corporate Office.”

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Resident Engineer. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.

C. Written Reports: Testing laboratory shall submit test reports to Resident Engineer, Contractor, unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to Resident Engineer immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:

1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Resident Engineer regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Resident Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.

B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with ASTM D698 and/or ASTM D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D6938 wherever possible. Field density tests utilizing ASTM D1556 or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the Resident Engineer before the tests are conducted.

    a. Building Slab Subgrade: At least one test of subgrade for every 185 m^2 (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m^2 (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
    b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
    c. Pavement Subgrade: One test for each 335 m^2 (400 square yards), but in no case fewer than two tests.
    d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.

e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.

f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to Resident Engineer. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.

C. Fill and Backfill Material Gradation: One test per 25 cubic yards stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM D422.

D. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.

E. Testing Materials: Test suitability of on-site and off-site borrow as directed by Resident Engineer.

3.2 NOT USED

3.3 NOT USED

3.4 LANDSCAPING:

A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.

1. Test for organic material by using ASTM D2974.
2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.

B. Submit laboratory test report of topsoil to Resident Engineer.

3.5 NOT USED

3.6 SITE WORK CONCRETE:

Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.7 NOT USED

3.8 CONCRETE:

A. Batch Plant Inspection and Materials Testing:

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of Resident Engineer with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by Resident Engineer.

2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to Resident Engineer.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:
1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor’s expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m^3 (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. Resident Engineer may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day’s pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m^3 (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m^3 (100 cubic yards) at random. For

pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.

6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
    a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:
    a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
    b. Inspect preparation of construction, expansion, and isolation joints.
16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:

a. Monitor and record amount of water added at project site.
b. Observe minimum and maximum mixing times.

18. Measure concrete flatwork for levelness and flatness as follows:
    a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
    b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
    c. Provide the Contractor and the Resident Engineer with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
19. Other inspections:
    a. Grouting under base plates.
    b. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by Resident Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to Resident Engineer. In test report, indicate the following information:
    a. Cylinder identification number and date cast.
    b. Specific location at which test samples were taken.
    c. Type of concrete, slump, and percent air.
    d. Compressive strength of concrete in MPa (psi).
    e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).
    f. Weather conditions during placing.
    g. Temperature of concrete in each test cylinder when test cylinder was molded.
    h. Maximum and minimum ambient temperature during placing.
    i. Ambient temperature when concrete sample in test cylinder was taken.
    j. Date delivered to laboratory and date tested.

3.9 REINFORCEMENT:

A. Review mill test reports furnished by Contractor.

B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.

C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.

D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.10 NOT USED

3.11 NOT USED

3.12 ARCHITECTURAL PRECAST CONCRETE:

A. Inspection at Plant: Forms, placement of reinforcing steel, concrete cover, and placement and finishing of concrete.

B. Concrete Testing: Test concrete including materials for concrete as required in Article CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.

C. Inspect members to insure specification requirements for curing and finishes have been met.

3.13 MASONRY:

A. Mortar Tests:

1. Laboratory compressive strength test:
   a. Comply with ASTM C780.
   b. Obtain samples during or immediately after discharge from batch mixer.
   c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
   d. Test one sample at 7 days and 2 samples at 28 days.
2. Two tests during first week of operation; one test per week after initial test until masonry completion.

B. Grout Tests:

1. Laboratory compressive strength test:
   a. Comply with ASTM C1019.
   b. Test one sample at 7 days and 2 samples at 28 days.
   c. Perform test for each 230 m^2 (2500 square feet) of masonry.

C. Masonry Unit Tests:

1. Laboratory Compressive Strength Test:
   a. Comply with ASTM C140.
   b. Test 3 samples for each 460 m^2 (5000 square feet) of wall area.

D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m^2 (5000 square feet) of wall area.

Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.14 NOT USED

3.15 NOT USED

3.16 NOT USED

3.17 NOT USED

3.18 NOT USED

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SECTION 01 57 00
ENVIRONMENTAL MANAGEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Special requirements for environmental management during construction operations.

B. Implementation and maintenance of Storm Water Pollution Prevention Plan prepared for the project (only if project will disturb more than one acre).

C. Working in and around protected species and associated environment

D. Slope Protection and Erosion Control practices

E. Monitoring requirements.

F. Definitions.

G. Environmental protection.

1.2 RELATED DOCUMENTS

A. Storm Water Pollution Prevention Plan (SWPPP) for the Hot Springs VA to be procured by contractor prior to construction from South Dakota Department of Environmental and Natural Resources, for areas where runoff from construction could enter State waters (only if project will disturb more than one acre).

1.3 DEFINITIONS

A. Environmental Pollution and Damage: Presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances; or degrade utility of environment for aesthetic, cultural, or historical purposes.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 ENVIRONMENTAL PROTECTION

A. Protection of natural resources: Comply with applicable regulations and these specifications. Preserve the natural resources within the Project boundaries and outside the limits of permanent Work performed under this Contract in their existing condition or restore to an equivalent or improved condition as approved by Owner.

1. Confine demolition and construction activities to work area limits indicated on the Drawings.
2. Disposal operations for demolished and waste materials that are not identified to be salvaged, recycled or reused:
    a. Remove debris, rubbish, and other waste materials resulting from demolition and construction operations, from site.

b. No burning permitted.

c. Transport materials with appropriate vehicles and dispose off site to areas that are approved for disposal by governing authorities having jurisdiction.

d. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways. Remove spillage and sweep, wash, or otherwise clean project site, streets, or highways.

3. Water resources:

a. Comply with requirements of the National Pollutant Discharge Elimination System (NPDES) and the State Pollutant Discharge Elimination System (SPDES).

b. Oily substances: Prevent oily or other hazardous substances from entering the ground, drainage areas, or local bodies of water. Store and service construction equipment at areas designated for collection of oil wastes.

c. Mosquito abatement: Prevent ponding of stagnant water conducive to mosquito breeding habitat. Provide positive drainage throughout construction

d. Prevent run-off from site during demolition and construction operations.

e. Stream Crossings: Equipment will not be permitted to ford live streams

4. Land resources: Prior to construction, identify land resources to be preserved within the Work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from Owner.

a. Earthwork: As specified in Division 31 and as follows:

1) Erodible Soils for Earthwork: Plan and conduct earthwork to minimize the duration of exposure of unprotected Soils for Earthwork, except where the constructed feature obscures borrow areas, quarries, and waste material areas. Clear areas in reasonably sized increments only as needed to use the areas developed. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.

2) Erosion and sedimentation control devices: Construct or install temporary and permanent erosion and sedimentation control features as required and delineated in the SWPPP (if applicable), and in accordance with Best Management Practices (BMP) of SD DOT.

3) Prevent and eliminate tracking of Soils for Earthwork and loose materials off site through cleaning of vehicle tires and other vehicle surfaces prior to exiting the site. Clean public roads of any material tracked from the site.

5. Air Resources: Develop and comply with IAQ Management Plan, Dust Control Plan, and as follows:
   a. Coordinate and comply with local Air Pollution Control District requirements.
   b. Prevent creation of dust, air pollution, and odors.
   c. Sequence construction to avoid disturbance to site to the greatest extent possible.
   d. Use mulch, water sprinkling, temporary enclosures, and other appropriate methods to limit dust and dirt rising and scattering in air to lowest practical level. Do not use water when it may create hazardous or other adverse conditions such as flooding and pollution.
   e. Store volatile liquids, including fuels and solvents, in closed containers.
   f. Properly maintain equipment to reduce gaseous pollutant emissions.
6. Fish and Wildlife Resources: Manage and control construction activities to minimize interference with, disturbance of, and damage to fish and wildlife.
   a. Do not disturb fish and wildlife.
   b. Do not alter water flows or otherwise significantly disturb the native habitat related to the project and critical to the survival of fish and wildlife, except as indicated or specified.
   c. Contractor to obtain clearance from Biologist if working within 500 feet of any nesting raptors.

3.2 ARCHEOLOGICAL/HISTORIC RESOURCES

A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the Contracting Officer’s Technical Representative verbally, and then with a written follow up.

3.3 FIELD QUALITY CONTROL

A. Comply with requirements of agencies having jurisdiction and as specified.

3.4 RECLAMATION AND RE-SEEDING

A. All disturbed areas resulting from this Project which are not occupied by permanent construction shall be re-claimed to pre-construction conditions. Re-establish turf of a quality and mix to match existing vegetation at the given location.

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

1. Waste Management Plan development and implementation.
2. Techniques to minimize waste generation.
3. Sorting and separating of waste materials.
4. Salvage of existing materials and items for reuse or resale.
5. Recycling of materials that cannot be reused or sold.

D. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, copper, etc).
7. Cardboard, paper and packaging.
8. Bitumen roofing materials.
9. Plastics (eg, ABS, PVC).
10. Carpet and/or pad.
11. Gypsum board.
12. Insulation.
13. Paint.
14. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

C. Lead Paint: Section 02 83 33.13, LEAD BASED PAINT REMOVAL AND DISPOSAL.

1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
   1. Excess or unusable construction materials.
   2. Packaging used for construction products.
   3. Poor planning and/or layout.
   4. Construction error.
   5. Over ordering.
   6. Weather damage.
   7. Contamination.
   8. Mishandling.
   9. Breakage.

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website http://www.cwm.wbdg.org provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.
E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
   1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
   2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.

O. Return: To give back reusable items or unused products to vendors for credit.

P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

B. Prepare and submit to the Resident Engineer a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
   1. Procedures to be used for debris management.
   2. Techniques to be used to minimize waste generation.
   3. Analysis of the estimated job site waste to be generated:

a. List of each material and quantity to be salvaged, reused, recycled.
b. List of each material and quantity proposed to be taken to a landfill.

4. Detailed description of the Means/Methods to be used for material handling.
   a. On site: Material separation, storage, protection where applicable.
   b. Off site: Transportation means and destination. Include list of materials.
      1) Description of materials to be site-separated and self-hauled to designated facilities.
      2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
   c. The names and locations of mixed debris reuse and recycling facilities or sites.
   d. The names and locations of trash disposal landfill facilities or sites.
   e. Documentation that the facilities or sites are approved to receive the materials.

C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.6 APPLICABLE PUBLICATIONS

A Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

B. U.S. Green Building Council (USGBC):
LEED Green Building Rating System for New Construction

1.7 RECORDS

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS

A. List of each material and quantity to be salvaged, recycled, reused.

B. List of each material and quantity proposed to be taken to a landfill.

C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.

B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.

C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.

B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies demolition and removal of concrete and other debris.

1.2 RELATED WORK:

A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished: Section 31 20 11, EARTH MOVING (SHORT FORM).

B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.

D. Lead Paint: Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.

E. Construction Waste Management: Section 017419 CONSTRUCTION WASTE MANAGEMENT.

F. Infectious Control: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7, INFECTION PREVENTION MEASURES.

1.3 PROTECTION:

A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.

B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations. Comply with requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES AND IMPROVEMENTS.

C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.

D. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or objectionable condition such as, but not limited to; ice, flooding, or pollution. Vacuum and dust the work area daily.

E. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work.

F. The work shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

G. The work shall comply with the requirements of Section 01 00 00, GENERAL REQUIREMENTS, Article 1.7 INFECTION PREVENTION MEASURES.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 DEMOLITION:

A. Debris, including brick, concrete, stone, metals and similar materials shall become property of Contractor and shall be disposed of by him daily, off the Medical Center to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Resident Engineer. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state or local permits, rules and/or regulations.

B. Remove and legally dispose of all materials, other than earth to remain as part of project work. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state or local permits, rules and/or regulations. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.

3.2 CLEAN-UP:

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer. Clean-up shall include off the Medical Center disposal of all items and materials not required to remain property of the Government as well as all debris and rubbish resulting from demolition operations.

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SECTION 02 83 33.13
LEAD-BASED PAINT REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies abatement and disposal of lead-based paint (LBP) and controls needed to limit occupational and environmental exposure to lead hazards.

B. Extent of Work:

1. Abetment and disposal of lead-based paint on areas of buildings 1,11 and 12 as shown on the construction drawings. This preparation can be accomplished by power washing of soffits, dormers, half timbered areas, stucco areas, and facia or by an approved method that is outlined in Section 1.5, below.
2. The areas identified for abetment and disposal will be re-painted by contractor.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. Code of Federal Regulations (CFR):

CFR 29 Part 1910.....Occupational Safety and Health Standards
CFR 29 Part 1926.....Safety and Health Regulations for Construction
CFR 40 Part 148.....Hazardous Waste Injection Restrictions
CFR 40 Part 260.....Hazardous Waste Management System: General
CFR 40 Part 261.....Identification and Listing of Hazardous Waste
CFR 40 Part 262.....Standards Applicable to Generators of Hazardous Waste
CRF 40 Part 263.....Standards Applicable to Transporters of Hazardous Waste
CFR 40 Part 264.....Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities
CFR 40 Part 265.....Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
CFR 40 Part 268.....Land Disposal Restrictions

CFR 49 Part 172.....Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements

CFR 49 Part 178.....Specifications for Packaging

C. National Fire Protection Association (NFPA):

NFPA 701-2004.....Methods of Fire Test for Flame-Resistant Textiles and Films

D. National Institute for Occupational Safety And Health (NIOSH)

NIOSH OSHA Booklet 3142. Lead in Construction

E. Underwriters Laboratories (UL)

UL 586-1996 (Rev 2009).. High-Efficiency, Particulate, Air Filter Units

F. American National Standards Institute

Z9.2-2006.....Fundamentals Governing the Design and Operation of Local Exhaust Systems

Z88.6-2006.....Respiratory Protection

1.4 DEFINITIONS

A. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

B. Lead Control Area: Area to limit to control construction activities.

1.5 **Approved Work Methods for LBP Removal**

A. Requirements for Removal of LBP Using Heat Based Methods

1. Open flame burning shall not be used to remove paint from exterior surfaces.
2. Heat guns and/or any other device used for removal of paint from exterior surfaces must be operated such that the temperature of the gun and/or other device does not exceed 1100^{o}F

B. Requirements for Removal of LBP Using Chemical Based Methods

1. Flammable paint strippers and paint strippers containing methylene chloride shall not be used to remove paint from exterior surfaces.
2. Non-flammable paint strippers which do not contain methylene chloride may be used for the removal of exterior paint provided that the manufacturers' instructions for use of the paint stripper are followed.

C. Requirements for Removal of LBP Using Mechanical Methods

1. Machine sanding and/or machine scraping shall be allowed only if the unit is controlled by a HEPA vacuum unit which immediately collects any and all spent abrasive, paint, particulate, dust and/or other debris generated by the operations. The sanding and/or scraping disk must not be wider than the direct surface upon which it is being applied.

2. Exterior surfaces must be misted with water prior to manual scraping. Dry scraping is not allowed.
3. Workers near the machine should wear half mask respirators rated by NIOSH as N100 (or HEPA) at a minimum until a negative assessment has been completed by the contractor’s CIH.
4. If this method is used, it is recommended that the work area be completely isolated to contain the dust generated by this process.

D. Requirements for Removal of LBP Using Abrasive Blasting
1. Dry abrasive blasting shall be allowed only if any and all spent abrasive, paint, particulate, dust and/or other debris generated by the blasting is immediately collected by a HEPA vacuum unit. Any person using a vacuum blast system must comply with the manufacturers’ guidelines when using the system.
2. Hydroblasting or wet abrasive blasting may be used for exterior lead paint removal provided that a vertical containment system is employed that prevents any and all fallout generated by the operation from traveling beyond the ground containment. Additionally any and all liquid waste generated by the operation must be adequately contained and handled in accordance with applicable waste disposal regulation.
3. NOTE: EPA recommends that only certified lead abatement workers be hired if Dry abrasive blasting or Hydroblasting option is chosen to remove LBP.

1.6 QUALITY ASSURANCE

A. The Contractor shall ensure the following:
1. Train employees performing construction work that may require the removal of materials that contain lead base paint. The minimum requirement is:
   a. “Lead Awareness” Training as outlined in OSHA 29 CFR 1926.62 or 29 CFR 1910.1025.
   b. A Lead abatement worker/supervisor training course as outlined in 24 CFR 35 or 40 CFR 745.
2. Create a work plan for conformance to the applicable standards.
3. Ensure work is performed in strict accordance with the work plan at all times.
4. Ensure hazardous exposure to personnel and to the environment is adequately controlled at all times.
5. Hazardous Waste Management: The Hazardous Waste Management plan shall comply with applicable requirements of Federal, State, and local hazardous waste regulations.
6. Comply with laws, ordinances, rules, and regulations of federal, state and local authorities regarding removing, handling, storing,

transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1910.1025. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work.

a. The following local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing of lead-contaminated materials apply:
   1. EPA
   2. South Dakota Department of Environment and Natural Resources

B. Pre-Construction Conference: Contractor shall meet with the Contracting Officer to discuss in detail the possibility of materials with lead-containing paint being removed and work plan. The paint removal operation must not be initiated until written approval is issued by the Contracting Officer of the VHA Black Hills Health Care System (BHHCS).

1.7 SUBMITTALS

A. Submit the following in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
   1. Work Plan: The work plan consists of:
      a. Instruction for establishing a Lead Control Area.
      b. The work methods chosen from Section 1.5 (above) to remove LBP on exterior surfaces.
   2. Records
      a. Completed and signed hazardous waste manifest from treatment or disposal facility.
      b. Certification of Medical Examinations
      c. Employee training certification
   3. Material Safety Data Sheets for paint removal products used in paint removal work.
   4. Safety Plan: The Safety Plan must include:
      a. The contractor is responsible for their employee safety and health and will comply with all federal, state and local regulations.
      b. Employees will wear the required Personal Protective Equipment (PPE). Respiratory Protection Equipment will be worn by employees when work creates dust and/or debris, unless the contractor can provide documentation of a “negative assessment” conducted on past similar or like project that employees are not overexposed to the permissible exposure limit of 50 µg/m^3. The BHHCS Industrial Hygienist/Safety Manager will approve this assessment before the paint removal operation starts.

c. Employees will remove dusty clothes and vacuum off at the end of a work period. Dusty clothes will be washed separately and not with their family clothing. **DO NOT** use compressed air to blow dust off clothing.
d. Contractor will post warning signs to prohibit eating, drinking or smoking inside the work area.
e. Ensure that employees wash their hands and face each and every time they stop work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PROTECTION

A. Lead Control Area Requirements. The following procedures must be followed prior to the initiation of LBP removal from any exterior surfaces of buildings:

1. Cover the ground with plastic sheeting or other disposable impermeable material extending 10 feet beyond the perimeter of surfaces undergoing lead base paint removal or a sufficient distance to collect falling paint debris, whichever is greater. Also erect vertical containment shrouds to prevent debris from moving beyond ground sheeting.
2. Close all doors and windows within 20 feet of the renovation. On multi-story buildings, close all doors and windows within 20 feet of the renovation on the same floor as the renovation, and close all doors and windows on all floors below that are on the same horizontal distance from the renovation.
3. Ensure that doors within the work area that will be used while the job is being performed are covered with plastic sheeting or other impermeable material in a manner that allows workers to pass through while confining dust and debris to the work area.
4. If abrasive blasting, machine sanding or machine scraping is to be employed, close all doors and windows on the walls to be blasted or sanded and securely seal them from the outside. Air conditioning units on these and adjacent walls must be turned off and covered.
5. If a wet removal procedure is to be used, a system must be in place prior to initiation of the removal which allows liquid waste to be collected from the ground containment and placed into appropriated containers for proper disposal.

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B. Protection of Existing Work to Remain: Perform paint removal work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition.

C. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6-mil plastic sheet and tape.

D. Personnel Protection: Personnel shall wear and use protective clothing and equipment as specified in the work plan. Eating, smoking, or drinking is not permitted in the lead control area.

3.2 WORK PROCEDURES

A. Complete construction activities including removal of lead based paint items in accordance with approved work plan. Use procedures and equipment required to limit occupational and environmental exposure to lead when lead-containing paint is removed in accordance with 29 CFR 1926.62, except as specified herein. Dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), federal, state, and local requirements.

3.3 LEAD-CONTAINING PAINT REMOVAL

A. Remove loose paint/materials within the buildings designated on the drawings. Take whatever precautions are necessary to minimize damage to the underlying substrate.

B. Outside Lead Paint Removal: Select removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. This paint removal process should be described in the lead-containing paint removal plan. Perform manual sanding and scraping to the maximum extent feasible.

3.4 SURFACE PREPARATIONS

Avoid flash rusting or other deterioration of the substrate. Provide surface preparations for painting in accordance with Section 09 91 00, PAINTING.

3.5 CLEANUP AND DISPOSAL

A. Cleanup: Maintain surfaces of the lead control area free of accumulations of paint chips and dust. Restrict the spread of dust and debris; keep waste from being distributed over the work area. At the end of each shift and when the paint removal operation has been completed, clean the area of visible lead paint contamination.

1. At the end of each workday, the following procedures must be followed:

a. If a dry removal procedure is used, spray any and all spent abrasive, paint, particulate, dust and/or other debris present on ground sheeting and/or other containments with a fine mist of water and collect the residue and place it in an appropriate container.
b. Visually inspect all areas, including areas that extend beyond the sheeted area, to determine whether any spent abrasive, paint, particulate, dust and/or other debris has escaped containment. If any spent abrasive, paint, particulate, dust and/or other debris generated by the LBP removal operation is observed it must be collected and placed in single 6-mil or double 4-mil plastic bags or another appropriate container.
c. If bags are used they must not be overloaded. Bags must be securely sealed and stored in such a way that they are not easily accessible to the public.
d. Liquid waste must be collected and stored in appropriate containers. Containers must be securely sealed and stored in a manner such that they are not easily accessible to the public.
e. Plastic sheets used for exterior containments, such as ground sheeting and vertical shrouds, must be removed and stored in a manner such that they are not easily accessible to the public.

2. At the completion of a LBP removal project, or at the time when all lead paint that is to be removed from a structure has been removed, the following procedures must be implemented:
a. Spray the ground sheeting as specified in section 3.5.A.1.a. Any and all residue must be collected and placed in an appropriate container. Ground sheeting should then be folded from the ends to the middle and placed into single 6-mil or double 4-mil plastic bags for disposal.
b. Collect any and all liquid waste in appropriate containers.
c. As specified in section 3.5.A.1.b. the area must be inspected for any spent abrasive, paint, particulate, dust and/or other debris which may have escaped containment and any and all such debris must be collected and placed in single 6-mil or double 4-mil plastic bags or an appropriate container.
d. Any and all bags and containers must be securely sealed. Removal and disposal must be in accordance with applicable solid and hazardous waste regulation of the South Dakota Department of Environmental and Natural Resources.

B. Disposal:

1. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing, which may produce airborne concentrations of lead particles.
2. Comply with land disposal restriction notification requirements as required by 40 CFR 268.
3. The VA BHHCS has conducted Toxicity characteristic leaching procedure (TCLP) on past LBP Abatement projects to determine how this waste should be disposed of. The results for these samples showed that the concentration of lead were well above the Regulatory Limit of 5.0 mg/L and below the mercury regulatory limit of 0.2 mg/L. Therefore the contractor will dispose of spend abrasive, paint, particulate, dust, and/or other debris as hazardous waste if the quantity exceeds 220 lbs. Otherwise, it can be disposed of in a landfill that accepts construction debris.

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SECTION 03 21 00

REINFORCING STEEL

PART 1 - GENERAL

1.1 SCOPE

A. Unless noted otherwise, furnish and install reinforcing for all concrete, including dowels, chairs, spacers, bolsters, etc., necessary for supporting and fastening reinforcement in place as shown on the Drawings and specified herein.

1.2 RELATED WORK

A. Cast-In-Place Concrete: Section 03 30 00.

1.3 QUALITY ASSURANCE

A. General:
1. Acceptable Manufacturers: Regularly engaged in the manufacture of steel bar and welded wire fabric reinforcing.
2. Installer Qualifications: Installation shall be done only by an installation firm normally engaged in this business. All work shall be performed by qualified mechanics working under an experienced supervisor.
3. Welding Qualifications: Welding procedures, welding operators and welders shall be qualified in accordance with AWS D1.4 - "Structural Welding Code Reinforcing Steel".
   a. Welders whose work fails to pass inspection shall be re-qualified before performing further welding.
4. Reinforcement Work shall conform to ACI 301, as minimum standards.
5. Allowable Tolerances:
   a. Fabrication:
      1) Sheared length: 1 inch.
      2) Depth of truss bars: Plus 0, minus ½-inch.
      3) Ties: Plus or minus ½-inch.
      4) All other bends: Plus or minus 1 inch.
   b. Placement:
      1) Concrete cover to form surfaces: Plus or minus ¼-inch.
      2) Minimum spacing between bars: Plus or minus ¼-inch.
      3) Crosswise of members: Spaced evenly within 2 inches of stated separation.
      4) Lengthwise of members: Plus or minus 2 inches.
6. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 2 bar diameters.

B. Standards and References: (Latest Edition unless otherwise noted):
1. American Concrete Institute (ACI).
   a. ACI 301 - "Specifications for Structural Concrete for Buildings".
   b. ACI 315 - "Details and Detailing of Concrete Reinforcing".
2. American Society for Testing and Materials (ASTM).
   a. ASTM A82 - "Cold Drawn Wire for Concrete Reinforcement".

b. ASTM A615 - "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement".
c. ASTM A706 – “Low Alloy Steel Deformed Bars for Concrete Reinforcement”.

3. Concrete Reinforcing Steel Institute (CRSI) - "Manual of Standard Practice".

C. Submittals: (Submit under provisions of Section 01 33 23)
1. Shop Drawings: Prepare in accordance ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of bars and shapes, dimensions and details of bar reinforcing and assemblies.
2. Certified mill test reports of supplied reinforcing indicating chemical and physical analysis. Tensile and bend tests shall be performed by the mill in accordance with ASTM A615.
3. Certificates of Compliance with specified standards:
a. Reinforcing bars.
4. Samples: Only as requested by A/E.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.

B. Handle and store materials to prevent contamination.
1. Store reinforcement in a manner that will prevent excessive rusting or coating with grease, oil, dirt, and other objectionable materials. Storage shall be in separate piles or racks so as to avoid confusion or loss of identification after bundles are broken.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcement Bars: ASTM A615, Grade 40 for No. 3 and smaller bars; ASTM A615, Grade 60 for No. 4 and larger bars.

B. Stirrups and Ties: ASTM A615, Grade 60 for No.4 and larger bars, ASTM A615, Grade 40 for No. 3 and smaller bars.

C. Steel Dowels: Same grade as bars to which dowels are connected.

D. Tie Wires: FS-QQ-W-461, annealed steel, black, 16 gauge minimum.

E. Bar Supports:
1. Typical, unless noted otherwise; CRSI Class 2 wire supports.
a. Do not use wood, brick or other objectionable materials.
b. Do not use galvanized supports.
2. Supports placed against ground: Pre-cast concrete blocks not less than 4 inches square with embedded wire.

PART 3 - EXECUTION

3.1 FABRICATION

A. Shop fabricate reinforcement to meet requirements of Drawings.

B. Fabricate reinforcement in accordance with the requirements of ACI 315 where specific details are not shown or where Drawings and Specifications are not more demanding.

C. Steel reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the Drawings shall not be used. Heating of bars for bending will not be permitted.

D. Reinforcing shall not be field bent or straightened without structural engineer's review.

E. Provide offsets in rebar (1:6 maximum) where required to maintain clearances.

3.2 CONDITION OF SURFACES

A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions have been corrected.

3.3 GENERAL

A. Notify COTR a minimum of 24-hours prior to planned concrete placement so reinforcement and forms can be inspected and approved.

B. Concrete shown without reinforcing shall be reinforced as similar parts shown with reinforcing except where concrete is specifically noted to be unreinforced.

3.4 PLACEMENT

A. All reinforcement shall be accurately set in place, lapped, spliced, spaced rigidly and securely held in place and tied with specified wire at all splices and crossing points. All wire tie ends shall point away from the form.
   1. Bars shall be in long lengths with laps and splices as shown. Offset laps in adjacent bars. Place steel with clearances and cover as shown. Bar laps shall be as indicated on the Drawings. Tie all laps and intersections with the specified wire.
   2. Maintain clear space between parallel bars not less than 1-1/2 times nominal diameter, but in no case shall clear space be less than 1-1/2 times maximum size concrete Aggregate.
   3. Reinforcing dowels for slabs and curb & gutter shall be placed as detailed. Install dowel through all construction and expansion joints for all slabs on grade.

B. Bar Supports: Support and securely fasten bars with chairs, spacers and ties to prevent displacement by construction loads or placement of concrete beyond the tolerances specified. Conform to CRSI as a minimum standard.

C. Steel Adjustment:
   1. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.
   2. Do not move bars beyond allowable without concurrence of COTR.
   3. Do not heat, bend, or cut bars without concurrence of COTR.
   4. Reinforcement shall not be bent after being embedded in hardened concrete.

D. Splices:
   1. Splice reinforcing as shown.
   2. Lap Splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
   3. Splice Devices: Install in accordance with manufacturer's written instructions. Obtain COTR approval before using.
   4. Do not splice bars except at locations shown without concurrence of COTR.

E. Welding:
   1. Welding is not permitted unless specifically detailed on Drawings or approved by COTR.

F. Reinforcement shall be free of mud, oil or other materials that may reduce bond at the time concrete is placed. Reinforcement with tightly adhered rust or mill scale will be accepted without cleaning provided that rusting has not reduced dimensions and weights below applicable standards. Remove loose rust.

G. Drawing Notes: Refer to notes on Drawings for additional reinforcement requirements.

END OF SECTION

SECTION 03 30 53
CAST-IN-PLACE CONCRETE (SHORT-FORM)

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies cast-in-place structural concrete and material and mixes for other concrete for retaining walls.

1.2 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 TOLERANCES:

A. ACI 117.

B. Slab Finishes: ACI 117, F-number method in accordance with ASTM E1155.

1.4 REGULATORY REQUIREMENTS:

A. ACI SP-66 ACI Detailing Manual

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Concrete Mix Design.

C. Shop Drawings: Reinforcing steel: Complete shop drawings.

D. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds.

1.6 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Concrete Institute (ACI):

117R-06.....Tolerances for Concrete Construction and Materials

211.1-91(R2002).....Proportions for Normal, Heavyweight, and Mass Concrete

211.2-98(R2004).....Proportions for Structural Lightweight Concrete

301-05.....Specification for Structural Concrete

305R-06.....Hot Weather Concreting

306R-2002.....Cold Weather Concreting

SP-66-04 .....ACI Detailing Manual

318/318R-05.....Building Code Requirements for Reinforced Concrete

347R-04.....Guide to Formwork for Concrete

C. American Society for Testing And Materials (ASTM):

A185-07.....Steel Welded Wire, Fabric, Plain for Concrete Reinforcement

A615/A615M-08.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A996/A996M-06.....Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement

C31/C31M-08.....Making and Curing Concrete Test Specimens in the Field

C33-07.....Concrete Aggregates

C39/C39M-05.....Compressive Strength of Cylindrical Concrete Specimens

C94/C94M-07.....Ready-Mixed Concrete

C143/C143M-05.....Standard Test Method for Slump of Hydraulic Cement Concrete

C150-07.....Portland Cement

C171-07.....Sheet Material for Curing Concrete

C172-07.....Sampling Freshly Mixed Concrete

C173-07.Air Content of Freshly Mixed Concrete by the Volumetric Method

C192/C192M-07.....Making and Curing Concrete Test Specimens in the Laboratory

C231-08.....Air Content of Freshly Mixed Concrete by the Pressure Method

C260-06.....Air-Entraining Admixtures for Concrete

C330-05.....Lightweight Aggregates for Structural Concrete

C494/C494M-08.....Chemical Admixtures for Concrete

C618-08.....Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

D1751-04.Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

D4397-02.....Polyethylene Sheeting for Construction, Industrial and Agricultural Applications

E1155-96(2008).....Determining F_F Floor Flatness and F_L Floor Levelness Numbers

PART 2 - PRODUCTS

2.1 FORMS:

Wood, plywood, metal, or other materials, approved by Resident Engineer, of grade or type suitable to obtain type of finish specified.

2.2 MATERIALS:

A. Portland Cement: ASTM C150, Type I or II.

B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.

C. Coarse Aggregate: ASTM C33, Size 67. Size 467 may be used for footings and walls over 300 mm (12 inches) thick. Coarse aggregate for applied topping and metal pan stair fill shall be Size 7.

D. Fine Aggregate: ASTM C33.

E. Lightweight Aggregate for Structural Concrete: ASTM C330, Table 1

F. Mixing Water: Fresh, clean, and potable.

G. Air-Entraining Admixture: ASTM C260.

H. Chemical Admixtures: ASTM C494.

I. Reinforcing Steel: ASTM A615 or ASTM A996, deformed. See structural drawings for grade.

J. Expansion Joint Filler: ASTM D1751.

K. Sheet Materials for Curing Concrete: ASTM C171.

L. Abrasive Aggregates: Aluminum oxide grains or emery grits.

M. Grout, Non-Shrinking: Premixed ferrous or non-ferrous, mixed and applied in accordance with manufacturer's recommendations. Grout shall show no settlement or vertical drying shrinkage at 3 days or thereafter based on initial measurement made at time of placement, and produce a compressive strength of at least 18mpa (2500 psi) at 3 days and 35mpa (5000 psi) at 28 days.

2.3 CONCRETE MIXES:

A. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.

B. Compressive strength at 28 days shall be not less than 30 Mpa (4000 psi).

D. Maximum slump for vibrated concrete is 100 mm (4 inches) tested in accordance with ASTM C143.

E. Cement and water factor (See Table I):

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE

Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/m^3 (lbs/c. yd)	Max. Water Cement Ratio	Min. Cement kg/m^3 (lbs/c. yd)	Max. Water Cement Ratio
35 (5000)[1,3]	375 (630)	0.45	385 (650)	0.40
30 (4000)[1,3]	325 (550)	0.55	340 (570)	0.50
25 (3000)[1,3]	280 (470)	0.65	290 (490)	0.55
25 (3000)[1,2]	300 (500)	*	310 (520)	*

1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 8.3 MPa (1200 psi) in excess of f'c. For concrete strengths above 35 Mpa (5000 psi), the proposed mix design shall achieve a compressive strength 9.7 MPa (1400 psi) in excess of f'c.
2. Lightweight Structural Concrete. Pump mixes may require higher cement values.
3. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.

* Determined by Laboratory in accordance with ACI 211.1 for normal concrete or ACI 211.2 for lightweight structural concrete.

F. Air-entrainment is required for all exterior concrete and as required for Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS. Air content shall conform with the following table:

TABLE I - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)

Nominal Maximum Size of Coarse Aggregate	Total Air Content Percentage by Volume
10 mm (3/8 in)	6 to 10
13 mm (1/2 in)	5 to 9
19 mm (3/4 in)	4 to 8
25 mm (1 in)	3 1/2 to 6 1/2
40 mm (1 1/2 in)	3 to 6

2.4 BATCHING & MIXING:

A. Store, batch, and mix materials as specified in ASTM C94.

1. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will

not be permitted. With each load of concrete delivered to project, ready-mixed concrete producer shall furnish, in duplicate, certification as required by ASTM C94.

PART 3 - EXECUTION

3.1 FORMWORK:

A. Installation conform to ACI 347. Sufficiently tight to hold concrete without leakage, sufficiently braced to withstand vibration of concrete, and to carry, without appreciable deflection, all dead and live loads to which they may be subjected.

B. Treating and Wetting: Treat or wet contact forms as follows:
   1. Coat plywood and board forms with non-staining form sealer. In hot weather cool forms by wetting with cool water just before concrete is placed.
   2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather cool metal forms by thoroughly wetting with water just before placing concrete.
   3. Use sealer on reused plywood forms as specified for new material.

C. Inserts, sleeves, and similar items: Flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned and built into construction, and maintained securely in place.

D. Construction Tolerances:
   1. Contractor is responsible for setting and maintaining concrete formwork to assure erection of completed work within tolerances specified to accommodate installation or other rough and finish materials. Remedial work necessary for correcting excessive tolerances is the responsibility of the Contractor. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
   2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

3.2 REINFORCEMENT:

Details of concrete reinforcement, unless otherwise shown, in accordance with ACI 318 and ACI SP-66. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

3.3 PLACING CONCRETE:

A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval of Resident Engineer before placing concrete. Provide screeds at required elevations for concrete slabs.

B. Before placing new concrete on or against concrete which has set, existing surfaces shall be roughened and cleaned free from all laitance, foreign matter, and loose particles.

C. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Vibration shall be carried on continuously with placing of concrete.

D. Hot weather placing of concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.

E. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from Resident Engineer.

3.4 PROTECTION AND CURING:

Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by Resident Engineer.

3.5 FORM REMOVAL:

Forms remain in place until concrete has a sufficient strength to carry its own weight and loads supported. Removal of forms at any time is the Contractor's sole responsibility.

3.6 SURFACE PREPARATION:

Immediately after forms have been removed and work has been examined and approved by Resident Engineer, remove loose materials, and patch all

stone pockets, surface honeycomb, or similar deficiencies with cement mortar made with 1 part portland cement and 2 to 3 parts sand.

3.7 FINISHES:

A. Vertical and Overhead Surface Finishes:

1. Exterior Exposed Areas: Fins, burrs and similar projections on surface shall be knocked off flush by mechanical means approved by Resident Engineer. No additional finishing is required.

3.8 RETAINING WALLS:

A. Concrete for retaining walls shall be as shown and air-entrained.

B. Finish exposed surfaces to match adjacent concrete surfaces, new or existing.

C. Porous backfill shall be placed as shown.

3.9 PRECAST CONCRETE ITEMS:

Precast concrete items, not specified elsewhere, shall be cast using 25 MPa (3000 psi) air-entrained concrete to shapes and dimensions shown. Finish surfaces to match corresponding adjacent concrete surfaces. Reinforce with steel as necessary for safe handling and erection.

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SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Section specifies mortar materials and mixes.

1.2 TESTING LABORATORY-CONTRACTOR RETAINED

A. Engage a commercial testing laboratory approved by Resident Engineer to perform tests specified below.

B. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Resident Engineer.

1.3 TESTS

A. Test mortar and materials specified.

B. Certified test reports.

C. Identify materials by type, brand name and manufacturer or by origin.

D. Do not use materials until laboratory test reports are approved by Resident Engineer.

E. After tests have been made and materials approved, do not change without additional test and approval of Resident Engineer.

F. Testing:

1. Test materials proposed for use for compliance with specifications in accordance with test methods contained in referenced specifications and as follows:

2. Mortar:

a. Test for compressive strength and water retention; ASTM C270.

b. Mortar compressive strengths 28 days as follows:

Type S: Minimum 12400 kPa (1800 psi) at 28 days.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Certificates; manufacturer’s literature and data.

1. Indicating that following items meet specifications:

a. Color admixture.

C. 18”x18” mock up of sand stone and mortar:

a. Color of sand stone and mortar to match existing building #1.

b. Sand stone blocks will be provided by the VA but may need to be cut by the contractor.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver masonry materials in original sealed containers marked with name of manufacturer and identification of contents.

B. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

C40-04.....Organic Impurities in Fine Aggregates for Concrete

C91-05.....Masonry Cement

C109-07.....Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-MM Cube Specimens)

C144-04.....Aggregate for Masonry Mortar

C150-05.....Portland Cement

C207-06.....Hydrated Lime for Masonry Purposes

C270-07.....Mortar for Unit Masonry

C307-03.....Tensile Strength of Chemical - Resistant Mortar, Grouts, and Monolithic Surfacing

C321-00/R05.....Bond Strength of Chemical-Resistant Mortars

C348-02.....Flexural Strength of Hydraulic Cement Mortars

C595-08.....Blended Hydraulic Cement

C780-07.....Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

C979-05.....Pigments for Integrally Colored Concrete

C1329-05.....Mortar Cement

PART 2 - PRODUCTS

2.1 HYDRATED LIME

A. ASTM C207, Type S.

2.2 AGGREGATE FOR MASONRY MORTAR

A. ASTM C144 and as follows:

1. Manufacturers requirements for type.

2.3 MASONRY CEMENT

A. ASTM C91. Blended masonry Type S. Portland, lime and sand.

2.4 PORTLAND CEMENT

A. ASTM C150, Type II.

2.5 WATER

A. Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.6 PREBLENDED MORTAR MIX, INTEGRAL WATER REPELLENT MORTAR MIX MATERIALS

A. Cement Spec Mix:

1. Pre-Blended Mortar Mix:
    a. Material: pre-blended factory mix of Portland cement and hydrated lime or masonry cement or mortar cement and sand aggregate mixtures.
    b. Mortar Type: property mixture, Type S.
    c. Aggregate Type: Fine.
    d. Material Standard for Aggregate: Comply with ASTM C144.
    e. Material Standard for Portland Cement: Comply with ASTM C150.
    f. Material Standard for Hydrated Lime: Comply with ASTM C207.
    g. Material Standard for Masonry Cement: Comply with ASTM C91.
    h. Material Standard for Mortar: Comply with ASTM C270.
    i. Material Standard for Masonry Grout: Comply with ASTM C476.
    j. Material Standard for Mortar Cement: Comply with ASTM C1329.
2. Spec Mix Integral Water Repellent Mortar:
    a. Material Description: Dry pre-blended mortar mixtures incorporating dry SPEC MIX Integral Water-Repellent Mortar Admixture.
    b. Water Penetration of Masonry (ASTM E514): No dampness reported.
    c. Mortar Type: Property Mixture, Type S.
    d. Compressive Strength of Masonry Mortar (ASTM C1384): Greater than 95% of control mortar (containing do admixtures).

B. Colored Mortar:
1. Maintain uniform mortar color for exposed work throughout.
2. Color of mortar for exposed work to match color of existing mortar.

2.7 COLOR ADMIXTURE

A. Pigments: ASTM C979.
B. Use mineral pigments only. Organic pigments are not acceptable.
C. Pigments inert, stable to atmospheric conditions, nonfading, alkali resistant and water insoluble.

PART 3 - EXECUTION

3.1 MIXING

A. Mix in a mechanically operated mortar mixer.
1. Mix mortar for at least three minutes but not more than five minutes.
B. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.
C. Mortar that has stiffened because of loss of water through evaporations:
1. Re-tempered by adding water to restore to proper consistency and workability.
2. Discard mortar that has reached its initial set or has not been used within two hours.

3.2 MORTAR USE LOCATION

A. Use Type S mortar for masonry containing vertical reinforcing bars (non-engineered) masonry below grade and setting cast stone and engineered reinforced unit masonry work.

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.

1. Support for Wall and Ceiling Mounted Items: (12, 14A, 14C)
2. Frames: (24E)
3. Guards
4. Covers and Frames for Pits and Trenches.
5. Gratings
6. Loose Lintels
7. Shelf Angles
8. Gas Racks
9. Plate Door Sill
10. Safety Nosings
11. Ladders
12. Railings: (10)
13. Catwalks and Platforms
14. Trap Doors with Ceiling Hatch
15. Sidewalk Access Doors
16. Screened Access Doors
17. Steel Counter or Bench Top Frame and Leg

1.2 RELATED WORK

A. Railings attached to steel stairs: Section 05 51 00, METAL STAIRS.

B. Colors, finishes, and textures: Section 09 06 00, SCHEDULE FOR FINISHES.

C. Prime and finish painting: Section 09 91 00, PAINTING.

D. Stainless steel corner guards: Section 10 26 00, WALL AND DOOR PROTECTION.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

Grating, each type	Floor plate
Trap door	Wheel guards
Ceiling hatch	Sidewalk Access door
Manhole Covers	Safety nosing

C. Shop Drawings:
   1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
   2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
   3. Provide templates and rough-in measurements as required.

D. Manufacturer's Certificates:
   1. Anodized finish as specified.
   2. Live load designs as specified.

E. Design Calculations for specified live loads including dead loads.

F. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

B. Each product type shall be the same and be made by the same manufacturer.

C. Assembled product to the greatest extent possible before delivery to the site.

D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):
   B18.6.1-97.....Wood Screws
   B18.2.2-87(R2005).....Square and Hex Nuts

C. American Society for Testing and Materials (ASTM):
   A36/A36M-08.....Structural Steel
   A47-99(R2009).....Malleable Iron Castings
   A48-03(R2008).....Gray Iron Castings
   A53-10.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123-09.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A167-99(R2009).....Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
A269-10.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service
A307-10.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
A312/A312M-09.....Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
A391/A391M-07.....Grade 80 Alloy Steel Chain
A653/A653M-10.....Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
A786/A786M-09.....Rolled Steel Floor Plate
B221-08.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes
B456-03(R2009).....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium
B632-08.....Aluminum-Alloy Rolled Tread Plate
C1107-08.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
F436-10.....Hardened Steel Washers
F468-10.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
F593-02(R2008).....Stainless Steel Bolts, Hex Cap Screws, and Studs
F1667-11.....Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):
D1.1-10.....Structural Welding Code Steel
D1.2-08.....Structural Welding Code Aluminum
D1.3-08.....Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)
AMP 521-01.....Pipe Railing Manual
AMP 500-06.....Metal Finishes Manual
MBG 531-09.....Metal Bar Grating Manual
MBG 532-09.....Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:
SP 1-04.....No. 1, Solvent Cleaning
SP 2-04.....No. 2, Hand Tool Cleaning
SP 3-04.....No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):
RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.
B. Ladders and Rungs: 120 kg (250 pounds) at any point.
C. Railings and Handrails: 900 N (200 pounds) in any direction at any point.
D. Floor Plates, Gratings, Covers, Trap Doors, Catwalks, and Platforms: 500 kg/m^2 (100 pounds per square foot). Use _____ kg (pounds) for concentrated loads. Use ____ kg/m^2 (pounds per square foot) for vehicle loads in the following areas : _____.
E. Manhole Covers: 1200 kg/m^2 (250 pounds per square foot).

2.2 MATERIALS

A. Structural Steel: ASTM A36.
B. Stainless Steel: ASTM A167, Type 302 or 304.
C. Aluminum, Extruded: ASTM B221, Alloy 6063-T5 unless otherwise specified. For structural shapes use alloy 6061-T6 and alloy 6061-T4511.
D. Floor Plate:
   1. Steel ASTM A786.
   2. Aluminum: ASTM B632.
E. Steel Pipe: ASTM A53.
   1. Galvanized for exterior locations.
   2. Type S, Grade A unless specified otherwise.
   3. NPS (inside diameter) as shown.
F. Cast-Iron: ASTM A48, Class 30, commercial pattern.
G. Malleable Iron Castings: A47.
H. Primer Paint: As specified in Section 09 91 00, PAINTING.
I. Stainless Steel Tubing: ASTM A269, type 302 or 304.
J. Modular Channel Units:
   1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
   2. Form channel with in turned pyramid shaped clamping ridges on each side.
   3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.

4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

K. Grout: ASTM C1107, pourable type.

L. Insect Screening: ASTM D3656.

2.3 HARDWARE

A. Rough Hardware:
1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:
1. Bolts with Nuts:
a. ASME B18.2.2.
b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
c. ASTM F468 for nonferrous bolts.
d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material
1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:
1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections
1. Except as otherwise specified, connections may be made by welding, riveting or bolting.

2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors
1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.
4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship
1. General:
   a. Fabricate items to design shown.
   b. Furnish members in longest lengths commercially available within the limits shown and specified.
   c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
   d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
   e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.

f. Prepare members for the installation and fitting of hardware.
g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.

2. Welding:
   a. Weld in accordance with AWS.
   b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
   c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
   d. Finish welded joints to match finish of adjacent surface.
3. Joining:
   a. Miter or butt members at corners.
   b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.
4. Anchors:
   a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
   b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
   a. Accurately cut, machine and fit joints, corners, copes, and miters.
   b. Fit removable members to be easily removed.
   c. Design and construct field connections in the most practical place for appearance and ease of installation.
   d. Fit pieces together as required.
   e. Fabricate connections for ease of assembly and disassembly without use of special tools.
   f. Joints firm when assembled.
   g. Conceal joining, fitting and welding on exposed work as far as practical.
   h. Do not show rivets and screws prominently on the exposed face.

i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:

1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.
2. Aluminum: NAAMM AMP 501.
   a. Mill finish, AA-M10, as fabricated, use unless specified otherwise.
   b. Clear anodic coating, AA-C22A41, chemically etched medium matte, with Architectural Class 1, 0.7 mils or thicker.
   c. Colored anodic coating, AA-C22A42, chemically etched medium matte with Architectural Class 1, 0.7 mils or thicker.
   d. Painted: AA-C22R10.
3. Steel and Iron: NAAMM AMP 504.
   a. Zinc coated (Galvanized): ASTM A123, G90 unless noted otherwise.
   b. Surfaces exposed in the finished work:
      1) Finish smooth rough surfaces and remove projections.
      2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
   c. Shop Prime Painting:
      1) Surfaces of Ferrous metal:
         a) Items not specified to have other coatings.
         b) Galvanized surfaces specified to have prime paint.
         c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
         d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
         e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.
      2) Non ferrous metals: Comply with MAAMM-500 series.
4. Stainless Steel: NAAMM AMP-504 Finish No. 4.

   SPEC WRITER NOTE: Specify items to receive chromium plating.

5. Chromium Plating: ASTM B456, satin or bright as specified, Service Condition No. SC2.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.
2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 SUPPORTS

A. General:
1. Fabricate ASTM A36 structural steel shapes as shown.
2. Use clip angles or make provisions for welding hangers and braces to overhead construction.
3. Field connections shall be welded.

2.6 NOT USED

2.15 RAILINGS

A. In addition to the dead load design railing assembly to support live load specified.
B. Fabrication General:
1. Provide continuous welded joints, dressed smooth and flush.
2. Standard flush fittings, designed to be welded, may be used.
3. Exposed threads will not be approved.
4. Form handrail brackets to size and design shown.
5. Exterior Post Anchors.
a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
C. Handrails:
1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.
D. Steel Pipe Railings:
1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.

4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Removable Rails:
   a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
   b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
   c. Continuously weld brackets to post.
   d. Provide slotted bolt holes in rail bracket.
   e. Weld bolt heads flush with top of rail.
   f. Weld flanged fitting to post where posts are installed in sleeves.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Items set into concrete or masonry.
   1. Provide temporary bracing for such items until concrete or masonry is set.
   2. Place in accordance with setting drawings and instructions.
   3. Build strap anchors, into masonry as work progresses.

C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.

D. Field weld in accordance with AWS.
   1. Design and finish as specified for shop welding.
   2. Use continuous weld unless specified otherwise.

E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. Secure escutcheon plate with set screw.

3.2 INSTALLATION OF SUPPORTS

A. Anchorage to structure.

1. Secure angles or channels and clips to overhead structural steel by continuous welding unless bolting is shown.
2. Secure supports to concrete inserts by bolting or continuous welding as shown.
3. Secure supports to mid height of concrete beams when inserts do not exist with expansion bolts and to slabs, with expansion bolts. unless shown otherwise.
4. Secure steel plate or hat channels to studs as detailed.

3.14 RAILINGS

A. Steel Posts:
1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
2. Install sleeves in concrete formwork.
3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in Section 07 92 00, JOINT SEALANTS—on exterior posts.
4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.
5. Secure sliding flanged fittings to posts at base with set screws.
6. Secure fixed flanged fittings to concrete with expansion bolts.
7. Secure posts to steel with welds.

B. Aluminum Railing, Stainless Steel Railing, and Ornamental Railing Posts:
1. Install pipe sleeves in concrete formwork.
2. Set posts in sleeve and pour grout to surface on exterior locations and to within 6 mm (1/4 inch) of surface for interior locations except to where posts are required to be removable.
3. Apply beveled bead of urethane sealant over sleeve at post perimeter for exterior posts and flush with surface for interior posts as specified in Section 07 92 00, JOINT SEALANTS.

C. Anchor to Walls:
1. Anchor rails to concrete or solid masonry with machine screws through flanged fitting to steel plate.
   a. Anchor steel plate to concrete or solid masonry with expansion bolts.
   b. Anchor steel plate to hollow masonry with toggle bolts.
2. Anchor flanged fitting with toggle bolt to steel support in frame walls.

D. Removable Rails:

1. Rest rails in brackets at each end and secure to bracket with stainless steel bolts and nuts where part of a continuous railing.
2. Rest rail posts in sleeves where not part of a continuous railing. Do not grout posts.

E. Gates:
1. Hang gate to swing as shown.
2. Bolt gate hinges to jamb post with clamp on or through bolts.

F. Chains:
1. Eye bolt chains to pipe posts.
2. Eye bolt anchoring at walls.
   a. Expansion bolt to concrete or solid masonry.
   b. Toggle bolt to hollow masonry of frame wall installed support.

G. Handrails:
1. Anchor brackets for metal handrails as detailed.
2. Install brackets within 300 mm (12 inches) of return of walls, and at evenly spaced intermediate points not exceeding 1200 mm (4 feet) on centers unless shown otherwise.
3. Expansion bolt to concrete or solid masonry.
4. Toggle bolt to installed supporting frame wall and to hollow masonry unless shown otherwise.

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SECTION 08 51 69.11
ALUMINUM STORM WINDOWS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Re-glazing of existing storm windows on Buildings 1 and 11 as shown on construction drawings.

B. Remove loose glazing compound, install glazing points as required for re-glazing. All window glazing and associated wood trim work shall follow Department of Interior historic window repair requirements. These requirements can be found on-line at: http://www.nps.gov/tps/how-to-preserve/briefs/9-wooden-windows.htm

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SECTION 09 91 00
PAINTING

PART 1-GENERAL

1.1 DESCRIPTION

A. Section specifies field painting.

B. Section specifies prime coats which may be applied in shop under other sections.

C. Painting includes coatings specified.

1.2 NOT USED

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

C. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.

1.4 DELIVERY AND STORAGE

A. Deliver materials to site in manufacturer's sealed container marked to show following:

1. Name of manufacturer.
2. Product type.
3. Batch number.
4. Instructions for use.
5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:

1. Federal Specification Number, where applicable, and name of material.
2. Surface upon which material is to be applied.
3. If paint or other coating, state coat types; prime, body or finish.

C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.

D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

1.5 NOT USED

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. American Conference of Governmental Industrial Hygienists (ACGIH):

ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)

ACGIH TLV-DOC-2012......Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. American National Standards Institute (ANSI):

A13.1-07................Scheme for the Identification of Piping Systems

D. American Society for Testing and Materials (ASTM):

D260-86..........Boiled Linseed Oil

E. Commercial Item Description (CID):

A-A-1555................Water Paint, Powder (Cementitious, White and Colors) (WPC) (cancelled)

A-A-3120................Paint, For Swimming Pools (RF) (cancelled)

F. Federal Specifications (Fed Spec):

TT-P-1411A..............Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

No. 1-12................Aluminum Paint (AP)

No. 4-12................Interior/ Exterior Latex Block Filler

No. 5-12................Exterior Alkyd Wood Primer

No. 7-12................Exterior Oil Wood Primer

No. 8-12................Exterior Alkyd, Flat MPI Gloss Level 1 (EO)

No. 9-12................Exterior Alkyd Enamel MPI Gloss Level 6 (EO)

No. 10-12...............Exterior Latex, Flat (AE)

No. 11-12...............Exterior Latex, Semi-Gloss (AE)

No. 18-12...............Organic Zinc Rich Primer

No. 22-12...............Aluminum Paint, High Heat (up to 590% - 1100F) (HR)

No. 26-12...............Cementitious Galvanized Metal Primer

No. 27-12...............Exterior / Interior Alkyd Floor Enamel, Gloss (FE)

No. 31-12.....Polyurethane, Moisture Cured, Clear Gloss (PV)
No. 36-12.....Knot Sealer
No. 43-12.....Interior Satin Latex, MPI Gloss Level 4
No. 44-12.....Interior Low Sheen Latex, MPI Gloss Level 2
No. 45-12.....Interior Primer Sealer
No. 46-12.....Interior Enamel Undercoat
No. 47-12.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5 (AK)
No. 48-12.....Interior Alkyd, Gloss, MPI Gloss Level 6 (AK)
No. 49-12.....Interior Alkyd, Flat, MPI Gloss Level 1 (AK)
No. 50-12.....Interior Latex Primer Sealer
No. 51-12.....Interior Alkyd, Eggshell, MPI Gloss Level 3
No. 52-12.....Interior Latex, MPI Gloss Level 3 (LE)
No. 53-12.....Interior Latex, Flat, MPI Gloss Level 1 (LE)
No. 54-12.....Interior Latex, Semi-Gloss, MPI Gloss Level 5 (LE)
No. 59-12.....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss (FE)
No. 60-12.....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
No. 66-12.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved) (FC)
No. 67-12.....Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR)
No. 68-12.....Interior/ Exterior Latex Porch & Floor Paint, Gloss
No. 71-12.....Polyurethane, Moisture Cured, Clear, Flat (PV)
No. 74-12.....Interior Alkyd Varnish, Semi-Gloss
No. 77-12.....Epoxy Cold Cured, Gloss (EC)
No. 79-12.....Marine Alkyd Metal Primer
No. 90-12.....Interior Wood Stain, Semi-Transparent (WS)
No. 91-12.....Wood Filler Paste
No. 94-12.....Exterior Alkyd, Semi-Gloss (EO)
No. 95-12.....Fast Drying Metal Primer
No. 98-12.....High Build Epoxy Coating
No. 101-12.....Epoxy Anti-Corrosive Metal Primer
No. 108-12.....High Build Epoxy Coating, Low Gloss (EC)
No. 114-12.....Interior Latex, Gloss (LE) and (LG)
No. 119-12.....Exterior Latex, High Gloss (acrylic) (AE)
No. 135-12.....Non-Cementitious Galvanized Primer
No. 138-12.....Interior High Performance Latex, MPI Gloss Level 2 (LF)

No. 139-12.....Interior High Performance Latex, MPI Gloss Level 3 (LL)
No. 140-12.....Interior High Performance Latex, MPI Gloss Level 4
No. 141-12.....Interior High Performance Latex (SG) MPI Gloss Level 5

PART 2 - PRODUCTS

2.1 MATERIALS

A. Exterior Oil Wood Primer:
   1. Diamond Vogel – Nu-Cling, or approved equal.
B. Exterior Acrylic Latex Enamel (EO)
   1. Diamond Vogel – Nu-Cling, or approved equal.
C. Exterior Alkyd Porch & Floor Enamel, High Gloss (FE)
   1. Diamond Vogel – Nu-Cling, or approved equal.

2.2 PAINT PROPERTIES

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
   1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
   2. Lead-Base Paint:
      a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
      b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
      c. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
   3. Asbestos: Materials shall not contain asbestos.
   4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.

5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high performance acrylic paints in place of alkyd paints, where possible.
7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
   1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
   2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.

B. Atmospheric and Surface Conditions:
   1. Do not apply coating when air or substrate conditions are:
      a. Less than 3 degrees C (5 degrees F) above dew point.
      b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
   2. Do no exterior painting when it is windy and dusty.
   3. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
   4. Apply only on clean, dry and frost free surfaces except as follows:
      a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
      b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.

3.2 SURFACE PREPARATION

A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.

B. General:
   1. Remove prefinished items not to be painted such as lighting fixtures, escutcheon plates, hardware, trim, and similar items for reinstallation after paint is dried.

2. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
3. See other sections of specifications for specified surface conditions and prime coat.
4. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry.

C. Wood:
1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

D. Ferrous Metals:
1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel

doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.

a. This includes flat head countersunk screws used for permanent anchors.
b. Do not fill screws of item intended for removal such as glazing beads.

4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

3.3 PAINT PREPARATION

A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
C. Apply each coat evenly and cover substrate completely.
D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by Resident Engineer.
E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
F. Apply by brush, roller or spray, except as otherwise specified.
G. Do not spray paint in existing occupied spaces unless approved by Resident Engineer, except in spaces sealed from existing occupied spaces.

1. Apply painting materials specifically required by manufacturer to be applied by spraying.

H. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.5 PRIME PAINTING

A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.

B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.

C. Prime rebates for stop and face glazing of wood, and for face glazing of steel.

D. Wood and Wood Particleboard:

1. Use same kind of primer specified for exposed face surface.

a. Exterior wood: MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer.

3.6 EXTERIOR FINISHES

A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Wood:

1. Do not apply finish coats on surfaces concealed after installation, top and bottom edges of wood doors and sash, or on edges of wood framed insect screens.

2. Two coats of // MPI 10 Exterior Latex, Flat (AE)) // MPI 11 (Exterior Latex, Semi-Gloss (AE)) // MPI 119 (Exterior Latex, High Gloss (acrylic) (AE)) // on exposed surfaces, except where transparent finish is specified.

3. Two coats of // MPI 31 (Polyurethane, Moisture Cured, Clear Gloss (PV)) // MPI 71 (Polyurethane, Moisture Cured, Clear Flat (PV)) // for transparent finish.

C. Wood:

1. Sanding:

a. Use 220-grit sandpaper.

b. Sand sealers and varnish between coats.

c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.

2. Sealers:

a. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.

b. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
c. Sand as specified.

3. Paint Finish:
a. One coat of // MPI 45 (Interior Primer Sealer) // MPI 46 (Interior Enamel Undercoat) // plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss (AK)) (SG).
b. One coat // MPI 66 (Interior Alkyd Fire retardant, Clear Top-Coat (ULC Approved) (FC) // MPI 67 (Interior Latex Fire Retardant, Top-Coat (ULC Approved) (FR), intumescent type (FR), on exposed wood // in attics with floors used for mechanical equipment // and above ceilings where shown //.
c. One coat of // MPI 45 Interior Primer Sealer) // MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 48 (Interior Alkyd Gloss (AK)).
d. Two coats of MPI 51 (Interior Alkyd, Eggshell) (AK)).

C. Steel and Ferrous Metal:
1. Two coats of MPI 8 (Exterior Alkyd, Flat (EO)), MPI 94 (Exterior Alkyd, Semi-Gloss (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).

3.9 PAINT COLOR

A. Color and gloss of finish coats is specified:
1. Building 11 Shingles Ramp – VA Mineral Rose.
2. Buildings 1 and 12 – All wood trim, windows, exterior doors and roof wood overhang – VA Dark Bronze.

3.14 PROTECTION CLEAN UP, AND TOUCH-UP

A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section applies to all sections of Division 26.

B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company’s system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company’s system, and obtain electric utility company approval for sizes and settings of these devices.

D. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

A. The International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards will be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, will be considered

if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
   a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
   b. Are periodically inspected by a NRTL.
   c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.

B. Product Qualification:

1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.

2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.

C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within eight hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 are the latest issue, unless otherwise noted.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COTR a minimum of 15 working days prior to the manufacturer’s performing the factory tests.

2. Four copies of certified test reports shall be furnished to the COTR two weeks prior to final inspection and not more than 90 days after completion of the tests.
3. When materials and equipment fail factory tests, and re-testing and re-inspection is required, the Contractor shall be liable for all additional expenses for the Government to witness re-testing.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
   1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
   2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
   3. Damaged equipment shall be repaired or replaced, as determined by the COTR.
   4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
   5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

A. All electrical work shall comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
   1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
   2. Before initiating any work, a job specific work plan must be developed by the Contractor with a peer review conducted and documented by the COTR and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
   3. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COTR.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working clearances shall not be less than specified in the NEC.

C. Inaccessible Equipment:
   1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
   2. "Readily accessible” is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles

such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

D. Electrical service entrance equipment and arrangements for temporary and permanent connections to the electric utility company’s system shall conform to the electric utility company's requirements. Coordinate fuses, circuit breakers and relays with the electric utility company’s system, and obtain electric utility company approval for sizes and settings of these devices.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards, switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by NFPA 70E. Label shall indicate the arc hazard boundary (inches), working distance (inches), arc flash incident energy at the working distance (calories/cm2), required PPE category and description including the glove rating, voltage rating of the equipment, limited approach distance (inches), restricted approach distance (inches), prohibited approach distance (inches), equipment/bus name, date prepared, and manufacturer name and address.

1.12 SUBMITTALS

A. Submit to the COTR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval will not be permitted.

C. All submittals shall include six copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.

1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
2. NOT USED
3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:

1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names,

addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.

3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation instructions.
   e. Safety precautions for operation and maintenance.
   f. Diagrams and illustrations.
   g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
   h. Performance data.
   i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
   j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals will be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the COTR with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.

5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 NOT USED

1.15 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the Government.

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests. Repair, replacement, and retesting shall be accomplished at no additional cost to the Government.

1.16 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

1.17 INSTRUCTION

A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.

B. Furnish the services of competent instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the COTR at least 30 days prior to the planned training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

---END---

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2 RELATED WORK

A. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire-resistant rated construction.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

E. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Installation of conductors and cables in manholes and ducts.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

A. Conductors and cables shall be thoroughly tested at the factory per NEMA to ensure that there are no electrical defects. Factory tests shall be certified.

1.5 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit the following data for approval:
      1) Electrical ratings and insulation type for each conductor and cable.
      2) Splicing materials and pulling lubricant.

2. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

B. American Society of Testing Material (ASTM):

D2301-10.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304-10.....Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005-10.....Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):

WC 70-09.....Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):

70-11.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-10.....Thermoset-Insulated Wires and Cables

83-08.....Thermoplastic-Insulated Wires and Cables

467-07.....Grounding and Bonding Equipment

486A-486B-03.....Wire Connectors

486C-04.....Splicing Wire Connectors

486D-05.....Sealed Wire Connector Systems

486E-09.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables

514B-04.....Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with NEMA, UL, as specified herein, and as shown on the drawings.

B. All conductors shall be copper.

C. Single Conductor and Cable:

1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
2. No. 8 AWG and larger: Stranded.
3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

D. NOT USED

E. Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
   a. Solid color insulation or solid color coating.
   b. Stripes, bands, or hash marks of color specified.
   c. Color using 19 mm (0.75 inches) wide tape.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
5. Conductors shall be color-coded as follows:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

6. Lighting circuit “switch legs”, and 3-way and 4-way switch “traveling wires,” shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COTR.

7. Color code for isolated power system wiring shall be in accordance with the NEC.

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.

B. Above Ground Splices for No. 10 AWG and Smaller:
   1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped conductors.
   3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
   1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
   2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
   3. Splice and insulation shall be product of the same manufacturer.
   4. All bolts, nuts, and washers used with splices shall be steel.

D. Above Ground Splices for 250 kcmil and Larger:
   1. Long barrel “butt-splice” or “sleeve” type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
   2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
   3. Splice and insulation shall be product of the same manufacturer.

E. Underground Splices for No. 10 AWG and Smaller:
   1. Solderless, screw-on, reusable pressure cable type, with integral insulation. Listed for wet locations, and approved for copper and aluminum conductors.
   2. The integral insulator shall have a skirt to completely cover the stripped conductors.

3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

F. Underground Splices for No. 8 AWG and Larger:

1. Mechanical type, of high conductivity and corrosion-resistant material. Listed for wet locations, and approved for copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.//

G. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

2.3 CONNECTORS AND TERMINATIONS

A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.

C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be steel.

2.4 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.

B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

B. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Install conductors in accordance with the NEC, as specified, and as shown on the drawings.

B. Install all conductors in raceway systems.

C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.

D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.

E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.

G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.

H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.

I. Conductor and Cable Pulling:

1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
2. Use nonmetallic pull ropes.
3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. All conductors in a single conduit shall be pulled simultaneously.
5. Do not exceed manufacturer’s recommended maximum pulling tensions and sidewall pressure values.

J. No more than three branch circuits shall be installed in any one conduit.

K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2 INSTALLATION IN MANHOLES

A. Train the cables around the manhole walls, but do not bend to a radius less than six times the overall cable diameter.

B. Fireproofing:

1. Install fireproofing on low-voltage conductors where the low-voltage conductors are installed in the same manholes with medium-voltage conductors.

2. Use fireproofing tape as specified in Section 26 05 13, MEDIUM-VOLTAGE CABLES, and apply the tape in a single layer, half-lapped, or as recommended by the manufacturer. Install the tape with the coated side towards the cable and extend it not less than 25 mm (1 inch) into each duct.
3. Secure the fireproofing tape in place by a random wrap of glass cloth tape.

3.3 SPLICE AND TERMINATION INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer’s published torque values using a torque screwdriver or wrench.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

3.4 CONDUCTOR IDENTIFICATION

A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

3.5 FEEDER CONDUCTOR IDENTIFICATION

A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.6 EXISTING CONDUCTORS

A. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.7 CONTROL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.

B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

3.8 CONTROL WIRING IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.
C. Wire markers shall retain their markings after cleaning.
D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.9 DIRECT BURIAL CABLE INSTALLATION

A. Tops of the cables:
   1. Below the finished grade: Minimum 600 mm (24 inches) unless greater depth is shown.
   2. Below road and other pavement surfaces: In conduit as specified, minimum 760 mm (30 inches) unless greater depth is shown.
   3. Do not install cables under railroad tracks.
B. Under road and paved surfaces: Install cables in concrete-encased galvanized steel rigid conduits. Size as shown on plans, but not less than 50 mm (2 inches) trade size with bushings at each end of each conduit run. Provide size/quantity of conduits required to accommodate cables plus one spare.
C. Work with extreme care near existing ducts, conduits, cables, and other utilities to prevent any damage.
D. Excavation and backfill is specified in Section 31 20 00, EARTH MOVING. In addition:
   1. Place 75 mm (3 inches) bedding sand in the trenches before installing the cables.
   2. Place 75 mm (3 inches) shading sand over the installed cables.
   3. Install continuous horizontal 25 mm by 200 mm (1 inch x 8 inches) preservative-impregnated wood planking 75 mm (3 inches) above the cables before backfilling.
E. Provide horizontal slack in the cables for contraction during cold weather.
F. Install the cables in continuous lengths. Splices within cable runs shall not be accepted.
G. Connections and terminations shall be listed submersible-type designed for the cables being installed.
H. Warning tape shall be continuously placed 300 mm (12 inches) above the buried cables.

3.10 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests: Inspect physical condition.
2. Electrical tests:
   a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
   b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
   c. Perform phase rotation test on all three-phase circuits.

---END---

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

SPEC WRITER NOTE: Delete // _____ // if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs. Insert additional provisions as required for this project.

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. “Grounding electrode system” refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.

C. The terms “connect” and “bond” are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

D. Section 26 12 19, PAD-MOUNTED, LIQUID-FILLED, MEDIUM-VOLTAGE TRANSFORMERS: pad-mounted, liquid-filled, medium-voltage transformers.

E. Section 26 13 13, MEDIUM-VOLTAGE CIRCUIT BREAKER SWITCHGEAR: Medium-voltage circuit breaker switchgear.

F. Section 26 23 13, GENERATOR PARALLELING CONTROLS: Generator paralleling controls.

G. Section 26 13 16, MEDIUM-VOLTAGE FUSIBLE INTERRUPTER SWITCHES: Medium-voltage fusible interrupter switches.

H. Section 26 22 00, LOW-VOLTAGE TRANSFORMERS: Low-voltage transformers.

I. Section 26 23 00, LOW-VOLTAGE SWITCHGEAR: Low-voltage switchgear.

J. Section 26 24 13, DISTRIBUTION SWITCHBOARDS: Low-voltage distribution switchboards.

K. Section 26 24 16, PANELBOARDS: Low-voltage panelboards.

L. Section 26 24 19, MOTOR CONTROL CENTERS: Motor control centers.

M. Section 26 32 13, ENGINE GENERATORS: Engine generators.

N. Section 26 36 23, AUTOMATIC TRANSFER SWITCHES: Automatic transfer switches.

O. Section 26 41 00, FACILITY LIGHTNING PROTECTION: Lightning protection.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
2. Test Reports:
   a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COTR.
3. Certifications:
   a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Society for Testing and Materials (ASTM):

B1-07.....Standard Specification for Hard-Drawn Copper Wire

B3-07.....Standard Specification for Soft or Annealed Copper Wire

B8-11.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-83.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

D. National Fire Protection Association (NFPA):
   70-11.....National Electrical Code (NEC)
   70E-12.....National Electrical Safety Code
   99-12.....Health Care Facilities
E. Underwriters Laboratories, Inc. (UL):
   44-10 .....Thermoset-Insulated Wires and Cables
   83-08 .....Thermoplastic-Insulated Wires and Cables
   467-07 .....Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.
B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors shall be stranded for final connection to motors, transformers, and vibrating equipment.
C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.
D. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

2.2 GROUND RODS

A. Steel or copper clad steel, 19 mm (0.75 inch) diameter by 3 M (10 feet) long.
B. Quantity of rods shall be as shown on the drawings, and as required to obtain the specified ground resistance.

2.3 CONCRETE ENCASED ELECTRODE

A. Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

2.4 GROUND CONNECTIONS

A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

B. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.5 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

2.6 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.7 GROUNDING BUS BAR

A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

PART 3 - EXECUTION

3.1 GENERAL

A. Install grounding equipment in accordance with the NEC, as shown on the drawings, and as specified herein.

B. System Grounding:
   1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformer.
   2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

D. For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS

A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.

B. Duct Banks and Manholes: Provide an insulated equipment grounding conductor in each duct containing medium-voltage conductors, sized per NEC except that minimum size shall be No. 2 AWG. Bond the equipment grounding conductors to the switchgear ground bus, to all manhole grounding provisions and hardware, to the cable shield grounding provisions of medium-voltage cable splices and terminations, and to equipment enclosures.

C. Pad-Mounted Transformers:
   1. Provide a driven ground rod and bond with a grounding electrode conductor to the transformer grounding pad.
   2. Ground the secondary neutral.

D. Lightning Arresters: Connect lightning arresters to the equipment ground bus or ground rods as applicable.

3.4 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):
   1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems,

building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.

2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.

C. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:

1. Connect the equipment grounding conductors to the ground bus.
2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

D. Transformers:

1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system.

3.5 RACEWAY

A. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:
1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.
2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.

I. Panelboard Bonding in Patient Care Areas: The equipment grounding terminal buses of the normal and essential branch circuit panel boards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than No. 10 AWG, installed in rigid metal conduit.

3.6 OUTDOOR METALLIC FENCES AROUND ELECTRICAL EQUIPMENT

A. Fences shall be grounded with a ground rod at each fixed gate post and at each corner post.

B. Drive ground rods until the top is 300 mm (12 inches) below grade. Attach a No. 4 AWG copper conductor by exothermic weld to the ground rods, and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 300 mm (12 inches) of fence mesh and fasten by two approved bronze compression fittings, one to bond the wire to post and the other to bond the wire to fence. Each gate section shall be bonded to its gatepost by a 3 mm x 25 mm (0.375 inch x 1 inch) flexible, braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.

3.7 CORROSION INHIBITORS

A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.8 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

B. In operating rooms and at intensive care and coronary care type beds, bond the medical gas piping and medical vacuum piping at the outlets directly to the patient ground bus.

3.9 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to the electrical grounding electrode system.

3.10 MAIN ELECTRICAL ROOM GROUNDING

A. Provide ground bus bar and mounting hardware at each main electrical room where incoming feeders are terminated, as shown on the drawings. Connect to pigtail extensions of the building grounding ring, as shown on the drawings.

3.11 EXTERIOR LIGHT POLES

A. Provide 6.1 M (20 feet) of No. 4 AWG bare copper coiled at bottom of pole base excavation prior to pour, plus additional unspliced length in and above foundation as required to reach pole ground stud.

3.12 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 5 ohms. Make any modifications or additions to the grounding electrode system necessary

for compliance without additional cost to the Government. Final tests shall ensure that this requirement is met.

B. Grounding system resistance shall comply with the electric utility company ground resistance requirements.

3.13 GROUND ROD INSTALLATION

A. For outdoor installations, drive each rod vertically in the earth, until top of rod is 610 mm (24 inches) below final grade.

B. For indoor installations, leave 100 mm (4 inches) of each rod exposed.

C. Where buried or permanently concealed ground connections are required, make the connections by the exothermic process, to form solid metal joints. Make accessible ground connections with mechanical pressure-type ground connectors.

D. Where rock or impenetrable soil prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified ground resistance.

3.14 ACCEPTANCE CHECKS AND TESTS

A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the COTR prior to backfilling. The Contractor shall notify the COTR 24 hours before the connections are ready for inspection.

---END---

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.

B. Section 07 60 00, FLASHING AND SHEET METAL: Fabrications for the deflection of water away from the building envelope at penetrations.

C. Section 07 84 00, FIRESTOPPING: Sealing around penetrations to maintain the integrity of fire rated construction.

D. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

E. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.

F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

G. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

H. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground conduits.

I. Section 31 20 00, EARTH MOVING: Bedding of conduits.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

A. Manufacturer's Literature and Data: Showing each cable type and rating. The specific item proposed and its area of application shall be identified on the catalog cuts.

B. Shop Drawings:

1. Size and location of main feeders.
2. Size and location of panels and pull-boxes.
3. Layout of required conduit penetrations through structural elements.

C. Certifications:
1. Two weeks prior to the final inspection, submit four copies of the following certifications to the COTR:
a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.
b. Certification by the contractor that the material has been properly installed.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American National Standards Institute (ANSI):
C80.1-05.....Electrical Rigid Steel Conduit
C80.3-05.....Steel Electrical Metal Tubing
C80.6-05.....Electrical Intermediate Metal Conduit

C. National Fire Protection Association (NFPA):
70-08.....National Electrical Code (NEC)

D. Underwriters Laboratories, Inc. (UL):
1-05.....Flexible Metal Conduit
5-04.....Surface Metal Raceway and Fittings
6-07.....Electrical Rigid Metal Conduit - Steel
50-95.....Enclosures for Electrical Equipment
360-093.....Liquid-Tight Flexible Steel Conduit
467-07.....Grounding and Bonding Equipment
514A-04.....Metallic Outlet Boxes
514B-04.....Conduit, Tubing, and Cable Fittings
514C-96.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-05.....Schedule 40 and 80 Rigid PVC Conduit and Fittings
651A-00.....Type EB and A Rigid PVC Conduit and HDPE Conduit
797-07.....Electrical Metallic Tubing
1242-06.....Electrical Intermediate Metal Conduit - Steel

E. National Electrical Manufacturers Association (NEMA):
TC-2-03.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and Tubing

FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 0.5 in [13 mm] unless otherwise shown. Where permitted by the NEC, 0.5 in [13 mm] flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
2. NOT USED
3. Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
4. Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
5. Flexible galvanized steel conduit: Shall conform to UL 1.
6. Liquid-tight flexible metal conduit: Shall conform to UL 360.
7. Direct burial plastic conduit: Shall conform to UL 651 and UL 651A, heavy wall PVC or high density polyethylene (PE).
8. Surface metal raceway: Shall conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.

f. Sealing fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.

2. NOT USED
3. Electrical metallic tubing fittings:
   a. Fittings and conduit bodies shall meet the requirements of UL 514B, ANSI C80.3, and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Compression couplings and connectors: Compression couplings and connectors: Concrete-tight and rain-tight, with connectors having insulated throats for 2 inch diameter and below.
   d. Setscrew couplings and connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding for conduit above 2 inch diameter.
   e. Indent-type connectors or couplings are prohibited.
   f. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible steel conduit fittings:
   a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.
   b. Clamp-type, with insulated throat.
5. Liquid-tight flexible metal conduit fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
6. Direct burial plastic conduit fittings:
   Fittings shall meet the requirements of UL 514C and NEMA TC3.
7. Surface metal raceway fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
8. Expansion and deflection couplings:
   a. Conform to UL 467 and UL 514B.
   b. Accommodate a 0.75 in [19 mm] deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:
1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:
1. UL-50 and UL-514A.
2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
3. Sheet metal boxes: Galvanized steel, except where otherwise shown.
4. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:
1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COTR prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the COTR as required by limited working space.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

A. In accordance with UL, NEC, as shown, and as specified herein.

B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where shown on drawings.

C. Install conduit as follows:

1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
5. Cut square, ream, remove burrs, and draw up tight.
6. Independently support conduit at 8 ft [2.4 M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.
7. Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.
8. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
9. Conduit installations under fume and vent hoods are prohibited.
10. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
12. Conduit bodies shall only be used for changes in direction, and shall not contain splices.

13. Do not use aluminum conduits in wet locations.

D. Conduit Bends:
   1. Make bends with standard conduit bending machines.
   2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
   3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
   1. Install conduit with wiring, including homeruns, as shown on drawings.
   2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COTR.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
   1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
   2. Align and run conduit in direct lines.
   3. Install conduit through concrete beams only:
      a. Where shown on the structural drawings.
      b. As approved by the COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
   4. Installation of conduit in concrete that is less than 3 in [75 mm] thick is prohibited.
      a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
      b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
      c. Install conduits approximately in the center of the slab so that there will be a minimum of 0.75 in [19 mm] of concrete around the conduits.
   5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:
   1. Conduit for conductors above 600 V: Rigid steel. Mixing different types of conduits indiscriminately in the same system is prohibited.
   2. Conduit for conductors 600 V and below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the same system is prohibited.

3. Align and run conduit parallel or perpendicular to the building lines.
4. Connect recessed lighting fixtures to conduit runs with maximum 6 ft [1.8 M] of flexible metal conduit extending from a junction box to the fixture.
5. Tightening setscrews with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
B. Conduit for Conductors above 600 V: Rigid steel. Mixing different types of conduits indiscriminately in the system is prohibited.
C. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.
D. Align and run conduit parallel or perpendicular to the building lines.
E. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
F. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
G. Surface metal raceways: Use only where shown.
H. Painting:
   1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
   2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 2 in [50 mm] high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 20 ft [6 M] intervals in between.

3.5 DIRECT BURIAL INSTALLATION

Refer to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

3.6 HAZARDOUS LOCATIONS

A. Use rigid steel conduit only, notwithstanding requirements otherwise specified in this or other sections of these specifications.
B. Install UL approved sealing fittings that prevent passage of explosive vapors in hazardous areas equipped with explosion-proof lighting fixtures, switches, and receptacles, as required by the NEC.

3.7 WET OR DAMP LOCATIONS

A. Unless otherwise shown, use conduits of rigid steel or IMC.
B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces,

constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

C. Unless otherwise shown, use rigid steel or IMC conduit within 5 ft [1.5 M] of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

3.8 MOTORS AND VIBRATING EQUIPMENT

A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.

B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water. Provide a green equipment grounding conductor with flexible metal conduit.

3.9 EXPANSION JOINTS

A. Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 3 in [75 mm] with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 in [125 mm] vertical drop midway between the ends. Flexible conduit shall have a bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for conduits 15 in [375 mm] and larger are acceptable.

C. Install expansion and deflection couplings where shown.

3.10 CONDUIT SUPPORTS, INSTALLATION

A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:
   1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
   2. Existing Construction:
      a. Steel expansion anchors not less than 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.
      b. Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].
      c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

E. Hollow Masonry: Toggle bolts.

F. Bolts supported only by plaster or gypsum wallboard are not acceptable.

G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

J. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

K. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush-mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.

C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

D. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.

E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] deep, with device covers for the wall material and thickness involved.

F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."
G. On all branch circuit junction box covers, identify the circuits with black marker.

- - - E N D - - -

SECTION 26 05 41
UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of underground ducts and raceways, and precast manholes and pullboxes to form a complete underground electrical raceway system.

B. The terms “duct” and “conduit” are used interchangeably in this section.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 31 20 11, EARTH MOVING (SHORT FORM): Trenching, backfill, and compaction.

1.3 QUALITY ASSURANCE

A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Coordinate layout and installation of ducts, manholes, and pullboxes with final arrangement of other utilities, site grading, and surface features.

1.4 SUBMITTALS

A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1. Shop Drawings:

   a. Submit sufficient information to demonstrate compliance with drawings and specifications.

   b. Submit information on manholes, pullboxes, ducts, and hardware. Submit manhole plan and elevation drawings, showing openings, pulling irons, cable supports, cover, ladder, sump, and other accessories.

   c. Proposed deviations from the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes, pullboxes, or duct banks at locations other than shown on the drawings, show

the proposed locations accurately on scaled site drawings, and submit to the COTR for approval prior to construction.

2. Certifications: Two weeks prior to the final inspection, submit the following.
   a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Concrete Institute (ACI):
Building Code Requirements for Structural Concrete
318-11/318M-11.....Building Code Requirements for Structural Concrete & Commentary
SP-66-04.....ACI Detailing Manual

C. American National Standards Institute (ANSI):
77-10.....Underground Enclosure Integrity

D. American Society for Testing and Materials (ASTM):
C478-12.....Standard Specification for Precast Reinforced Concrete Manhole Sections
C858-10e1.....Underground Precast Concrete Utility Structures
C990-09.....Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

E. National Electrical Manufacturers Association (NEMA):
TC 2-03.....Electrical Polyvinyl Chloride (PVC) Conduit
TC 3-04.....Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit And Tubing
TC 6 & 8-03.....Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installations
TC 9-04.....Fittings For Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installation

F. National Fire Protection Association (NFPA):
70-11.....National Electrical Code (NEC)
70E-12.....National Electrical Safety Code

G. Underwriters Laboratories, Inc. (UL):

6-07.....Electrical Rigid Metal Conduit-Steel

467-07.....Grounding and Bonding Equipment

651-11.....Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

651A-11.....Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

651B-07.....Continuous Length HDPE Conduit

PART 2 - PRODUCTS

2.1 PRE-CAST CONCRETE MANHOLES AND HARDWARE

A. Structure: Factory-fabricated, reinforced-concrete, monolithically-poured walls and bottom. Frame and cover shall form top of manhole.

B. Cable Supports:

1. Cable stanchions shall be hot-rolled, heavy duty, hot-dipped galvanized "T" section steel, 56 mm (2.25 inches) x 6 mm (0.25 inch) in size, and punched with 14 holes on 38 mm (1.5 inches) centers for attaching cable arms.
2. Cable arms shall be 5 mm (0.1875 inch) gauge, hot-rolled, hot-dipped galvanized sheet steel, pressed to channel shape. Arms shall be approximately 63 mm (2.5 inches) wide x 350 mm (14 inches) long.
3. Insulators for cable supports shall be porcelain, and shall be saddle type or type that completely encircles the cable.
4. Equip each cable stanchion with one spare cable arm, with three spare insulators for future use.

C. Ladder: Aluminum or fiberglass with 400 mm (16 inches) rung spacing. Provide securely-mounted ladder for every manhole over 1.2 M (4 feet) deep.

D. Ground Rod Sleeve: Provide a 75 mm (3 inches) PVC sleeve in manhole floors so that a driven ground rod may be installed.

E. Sump: Provide 305 mm x 305 mm (12 inches x 12 inches) covered sump frame and grated cover.

2.2 PULLBOXES

A. General: Size as indicated on the drawings. Provide pullboxes with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Cover material shall be identical to pullbox material. Covers shall have molded lettering, ELECTRIC or SIGNAL as applicable. Pullboxes shall comply with the requirements of ANSI 77 Tier 22 loading. Provide pulling irons, 22 mm

(0.875 inch) diameter galvanized steel bar with exposed triangular-shaped opening.

B. Polymer Concrete Pullboxes: Shall be molded of sand, aggregate, and polymer resin, and reinforced with steel, fiberglass, or both. Pullbox shall have open bottom.

C. Fiberglass Pullboxes: Shall be sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

D. Concrete Pullboxes: Shall be monolithically-poured reinforced concrete.

2.3 DUCTS

A. Number and sizes shall be as shown on the drawings.

B. Ducts (concrete-encased):

1. Plastic Duct:

a. UL 651 and 651A Schedule 40 PVC conduit.

b. Duct shall be suitable for use with 90˚ C (194˚ F) rated conductors.

2. Conduit Spacers: Prefabricated plastic.

C. Ducts (direct-burial):

1. Plastic duct:

a. UL 651, 651A, and 651B,Schedule 80 PVC or HDPE conduit.

b. Duct shall be suitable for use with 75˚ C (167˚ F) rated conductors.

2. Rigid metal conduit: UL6 and NEMA RN1 galvanized rigid metal, half-lap wrapped with 10 mil PVC tape.

2.4 GROUNDING

A. Ground Rods and Ground Wire: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.5 WARNING TAPE

A. 4-mil polyethylene 75 mm (3 inches) wide detectable tape, red with black letters, imprinted with “CAUTION - BURIED ELECTRIC CABLE BELOW” or similar.

2.6 PULL ROPE FOR SPARE DUCTS

A. Plastic with 890 N (200 lb) minimum tensile strength.

PART 3 - EXECUTION

3.1 MANHOLE AND PULLBOX INSTALLATION

A. Assembly and installation shall be per the requirements of the manufacturer.

1. Install manholes and pullboxes level and plumb.

2. Units shall be installed on a 300 mm (12 inches) thick level bed of 90% compacted granular fill, well-graded from the 25 mm (1 inches) sieve to the No. 4 sieve. Granular fill shall be compacted with a minimum of four passes with a plate compactor.

B. Access: Ensure the top of frames and covers are flush with finished grade.

C. Grounding in Manholes:

1. Ground Rods in Manholes: Drive a ground rod into the earth, through the floor sleeve, after the manhole is set in place. Fill the sleeve with sealant to make a watertight seal. Rods shall protrude approximately 100 mm (4 inches) above the manhole floor.
2. Install a No. 3/0 AWG bare copper ring grounding conductor around the inside perimeter of the manhole and anchor to the walls with metallic cable clips.
3. Connect the ring grounding conductor to the ground rod by an exothermic welding process.
4. Bond the ring grounding conductor to the duct bank equipment grounding conductors, the exposed non-current carrying metal parts of racks, sump covers, and like items in the manholes with a minimum No. 6 AWG bare copper jumper using an exothermic welding process.

D. Manhole Lighting: Provide NEMA 3R lighting switch mounted no more than 600 mm (2 feet) from top of ladder and a 27 W compact fluorescent wet location light fixture in manhole. Provide dedicated 20 mm (0.75 inch) direct-buried conduit and conductors to nearest electrical panelboard.

E. Sump Pump: Provide 120V cord and plug connected sump pump complete with float switch, thermal overload protection, and GFCI receptacle mounted in NEMA 3R boxes in manhole. Provide dedicated 20 mm (0.75 inch) direct-buried conduit and conductors to nearest electrical panelboard.

3.2 TRENCHING

A. Refer to Section 31 20 11 EARTH MOVING (SHORT FORM) for trenching, backfilling, and compaction.

B. Before performing trenching work at existing facilities, a Ground Penetrating Radar Survey shall be carefully performed by a certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems.

C. Work with extreme care near existing ducts, conduits, and other utilities to avoid damaging them.

D. Cut the trenches neatly and uniformly.

E. For Concrete-Encased Ducts:
   1. After excavation of the trench, stakes shall be driven in the bottom of the trench at 1.2 M (4 foot) intervals to establish the grade and route of the duct bank.
   2. Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.
   3. The walls of the trench may be used to form the side walls of the duct bank, provided that the soil is self-supporting and that the concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
   4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.

F. Individual conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place using rigid metal conduit, or bored using plastic utilities duct or PVC conduit, as approved by the COTR.

3.3 DUCT INSTALLATION

A. General Requirements:
   1. Ducts shall be in accordance with the NEC, as shown on the drawings, and as specified.
   2. Join and terminate ducts with fittings recommended by the manufacturer.
   3. Slope ducts to drain towards manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 100 mm (4 inch) in 30 M (100 feet).
   4. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) outside the building foundation. Tops of conduits below building slab shall be minimum 610 mm (24 inches) below bottom of slab.
   5. Stub-ups and sweeps to equipment mounted on outdoor concrete slabs shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) away from the edge of slab.
   6. Install insulated grounding bushings on the conduit terminations.

7. Radius for sweeps shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter.
8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 75 mm (3 inches) above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 1.5 M (5 feet). Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during concrete pour. Tie wires shall not act as substitute for spacers.
9. Duct lines shall be installed no less than 300 mm (12 inches) from other utility systems, such as water, sewer, chilled water.
10. Clearances between individual ducts:
    a. For similar services, not less than 75 mm (3 inches).
    b. For power and signal services, not less than 150 mm (6 inches).
11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
14. Spare Ducts: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.
15. Duct Identification: Place continuous strip of warning tape approximately 300 mm (12 inches) above ducts before backfilling trenches. Warning tape shall be preprinted with proper identification.
16. Duct Sealing: Seal ducts, including spare ducts, at building entrances and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of foreign objects and material, moisture, and gases.
17. Use plastic ties to secure cables to insulators on cable arms. Use minimum two ties per cable per insulator.

B. Concrete-Encased Ducts:

1. Install concrete-encased ducts for medium-voltage systems, low-voltage systems, and signal systems, unless otherwise shown on the drawings.

2. Duct banks shall be single or multiple duct assemblies encased in concrete. Ducts shall be uniform in size and material throughout the installation.
3. Tops of concrete-encased ducts shall be:
   a. Not less than 600 mm (24 inches) and not less than shown on the drawings, below finished grade.
   b. Not less than 750 mm (30 inches) and not less than shown on the drawings, below roads and other paved surfaces.
   c. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.
   d. Conduits crossing under grade slab construction joints shall be installed a minimum of 1.2 M (4 feet) below slab.
4. Extend the concrete envelope encasing the ducts not less than 75 mm (3 inches) beyond the outside walls of the outer ducts.
5. Within 3 M (10 feet} of building and manhole wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.
6. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.
7. Where new ducts and concrete envelopes are to be joined to existing manholes, pullboxes, ducts, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions.
8. Duct joints in concrete may be placed side by side horizontally, but shall be staggered at least 150 mm (6 inches) vertically.
9. Pour each run of concrete envelope between manholes or other terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 19 mm (0.75 inch) reinforcing rod dowels extending 450 mm (18 inches) into concrete on both sides of joint near corners of envelope.
10. Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by COTR.

C. Direct-Burial Ducts:
1. Install direct-burial ducts only where shown on the drawings. Provide direct-burial ducts only for low-voltage power and lighting branch circuits.
2. Tops of ducts shall be:

a. Not less than 600 mm (24 inches) and not less than shown on the drawings, below finished grade.
b. Not less than 750 mm (30 inches) and not less than shown on the drawings, below roads and other paved surfaces.
c. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.

3. Do not kink the ducts. Compaction shall not deform the ducts.//

D. Connections to Manholes: Ducts connecting to manholes shall be flared to have an enlarged cross-section to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding manhole opening dimensions by no less than 300 mm (12 inches) in each direction. Perimeter of the duct bank opening in the manhole shall be flared toward the inside or keyed to provide a positive interlock between the duct and the wall of the manhole. Use vibrators when this portion of the encasement is poured to ensure a seal between the envelope and the wall of the structure.

E. Connections to Existing Manholes: For duct connections to existing manholes, break the structure wall out to the dimensions required and preserve the steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

F. Connections to Existing Ducts: Where connections to existing ducts are indicated, excavate around the ducts as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.

G. Partially-Completed Ducts: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable plugs. Fit concrete envelope of a partially completed ducts with reinforcing steel extending a minimum of 600 mm (2 feet) back into the envelope and a minimum of 600 mm (2 feet) beyond the end of the envelope. Provide one No. 4 bar in each corner, 75 mm (3 inches) from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 300 mm (12 inches) apart. Restrain reinforcing assembly from moving during pouring of concrete.

3.4 ACCEPTANCE CHECKS AND TESTS

A. Duct Testing and Cleaning:

1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct, and to test for out-of-round conditions.
2. The mandrel shall be not less than 300 mm (12 inches) long, and shall have a diameter not less than 13 mm (0.5 inch) less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
3. If testing reveals obstructions or out-of-round conditions, the Contractor shall replace affected section(s) of duct and retest to the satisfaction of the COTR at no cost to the Government.
4. Mandrel pulls shall be witnessed by the COTR.

---END---

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of exterior luminaires, poles, and supports.

1.2 RELATED WORK

A. Section 09 06 00, SCHEDULE FOR FINISHES: Finishes for exterior light poles and luminaires.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

C. Section 26 05 13, MEDIUM-VOLTAGE CABLES: Medium voltage cables for series-connected street lighting.

D. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.

E. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

F. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.

G. Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION: Underground handholes and conduits.

H. Section 26 09 23, LIGHTING CONTROLS: Controls for exterior lighting.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Shop Drawings:

1. Clearly present sufficient information to determine compliance with drawings and specifications.
2. Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, poles, luminaires, lamps, and accessories. Include electronic photometric files in IES format, or provide link (URL) to manufacturer’s website that contains

photometric data for each specific fixture used, excluding wallpack fixtures.

C. Manuals: Two weeks prior to final inspection, submit four copies of operating and maintenance manuals to the COTR. Include technical data sheets, wiring and connection diagrams, and information for ordering replacement lamps, ballasts, and parts.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR:

1. Certification by the manufacturer that the materials are in accordance with the drawings and specifications.
2. Certification by the contractor that the complete installation has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. Aluminum Association Inc. (AA):

AAH35.1-06.....Alloy and Temper Designation Systems for Aluminum

C. American Association of State Highway and Transportation Officials (AASHTO):

LTS-5-09 .....Structural Supports for Highway Signs, Luminaires and Traffic Signals

D. American Concrete Institute (ACI):

318-05 .....Building Code Requirements for Structural Concrete

E. American National Standards Institute (ANSI):

C81.61-09 .....Electrical Lamp Bases – Specifications for Bases (Caps) for Electric Lamps

F. American Society for Testing and Materials (ASTM):

A123/A123M-09 .....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M-09.....Zinc Coating (Hot-Dip) on Iron and Steel Hardware

B108-03a-08 .....Aluminum-Alloy Permanent Mold Castings

C1089-06 .....Spun Cast Prestressed Concrete Poles

G. Federal Aviation Administration (FAA):

AC 70/7460-IK-07.....Obstruction Lighting and Marking
AC 150/5345-43F-06.....Obstruction Lighting Equipment

H. Illuminating Engineering Society of North America (IESNA)
HB-9-00.....Lighting Handbook
RP-8-05.....Roadway Lighting
RP-20-98.....Lighting for Parking Facilities
RP-33-99.....Lighting for Exterior Environments
LM-5-96.....Photometric Measurements of Area and Sports Lighting Installations
LM-50-99.....Photometric Measurements of Roadway Lighting Installations
LM-52-99.....Photometric Measurements of Roadway Sign Installations
LM-64-01.....Photometric Measurements of Parking Areas
LM-72-97.....Directional Positioning of Photometric Data
LM-79-08.....Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products
LM-80-08.....Approved Method for Measuring Lumen Maintenance of LED Light Sources

I. National Electrical Manufacturers Association (NEMA):
C78.41-06.....Electric Lamps – Guidelines for Low-Pressure Sodium Lamps
C78.42-07 .....Electric Lamps – Guidelines for High-Pressure Sodium Lamps
C78.43-07 .....Electric Lamps – Single-Ended Metal-Halide Lamps
C78.1381-98.....Electric Lamps – 70-Watt M85 Double-Ended Metal-Halide Lamps
C82.4-02 .....Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
C136.3-05 .....For Roadway and Area Lighting Equipment – Luminaire Attachments
C136.17-05 .....Roadway and Area Lighting Equipment – Enclosed Side-Mounted Luminaires for Horizontal-Burning High-Intensity-Discharge Lamps – Mechanical Interchangeability of Refractors

ICS 2-00 (R2005) .....Controllers, Contactors and Overload Relays Rated 600 Volts

ICS 6-93 (R2006) .....Enclosures

J. National Fire Protection Association (NFPA):

70-08 .....National Electrical Code (NEC)

K. Underwriters Laboratories, Inc. (UL):

496-08 .....Lampholders

773-95.....Plug-In, Locking Type Photocontrols for Use with Area Lighting

773A-06 .....Nonindustrial Photoelectric Switches for Lighting Control

1029-94.....High-Intensity-Discharge Lamp Ballasts

1598-08 .....Luminaires

8750-08.....Light Emitting Diode (LED) Light Sources for Use in Lighting Products

1.6 DELIVERY, STORAGE, AND HANDLING

Provide manufacturer’s standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 12 in [305 mm] above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.2 POLES

A. General:

1. Poles shall be as shown on the drawings, and as specified. Finish shall be as specified on the drawings.
2. The pole and arm assembly shall be designed for wind loading of 100 mph [161 km/hr], with an additional 30% gust factor, supporting luminaire(s) and accessories such as shields, banner arms, and banners that have the effective projected areas indicated. The effective projected area of the pole shall be applied at the height of the pole base, as shown on the drawings.
3. Poles shall be embedded anchor-bolt type designed for use with underground supply conductors. Poles shall have handhole having a

minimum clear opening of 2.5 x 5 in [65 x 125 mm]. Handhole covers shall be secured by stainless steel captive screws.

4. Provide a steel-grounding stud opposite handhole openings, designed to prevent electrolysis when used with copper wire.
5. Provide a base cover that matches the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts.
6. Hardware and Accessories: All necessary hardware and specified accessories shall be the product of the pole manufacturer.
7. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Types:

1. Aluminum: Provide 1800’s period appropriate aluminum poles manufactured of corrosion-resistant AA AAH35.1 aluminum alloys conforming to AASHTO LTS-4. Poles shall be seamless extruded or spun seamless type.
2. Steel: Provide 1800’s period appropriate steel poles having minimum 11-gauge steel with minimum yield/strength of 48,000 psi and factory finish.

2.3 FOUNDATIONS FOR POLES

A. The contractor shall submit a detailed drawing of the foundation plan before installing for approval to the COTR before construction including loading and reinforcement.

B. Foundations shall be cast-in-place concrete, having 3000 psi minimum 28-day compressive strength.

C. Foundations shall support the effective projected area of the specified pole, arm(s), luminaire(s), and accessories, such as shields, banner arms, and banners, under wind conditions previously specified in this section.

D. Place concrete in spirally-wrapped treated paper forms for round foundations, and construct forms for square foundations.

E. Rub-finish and round all above-grade concrete edges to approximately 0.25 in [6 mm] radius.

F. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings. Anchor bolts shall be in a welded cage or properly positioned by the tiewire to stirrups.

G. Prior to concrete pour, install electrode per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.4 LUMINAIRES

A. Per UL 1598 and NEMA C136.17. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping.

B. Light distribution pattern types shall be as shown on the drawings.

C. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.

D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

E. Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking-type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61 and UL 496.

F. Pre-wire internal components to terminal strips at the factory.

G. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.

H. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.

I. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials. Where indicated on drawings, provide finishes as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

J. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.5 LAMPS

A. Install the proper lamps in every luminaire installed and every existing luminaire relocated or reinstalled.

B. Lamps shall be general-service, outdoor lighting types.

C. High-Pressure Sodium (HPS) Lamps: NEMA C78.42, CRI 21 (minimum), wattage as indicated. Lamps shall have minimum average rated life of 24,000 hours.

D. Low-Pressure Sodium (LPS) Lamps: NEMA C78.43.

E. Metal-Halide Lamps: NEMA C78.43 or NEMA C78.1381.

F. LED sources shall meet the following requirements:

1. Operating temperature rating shall be between -40˚ F [-40˚ C] and 120˚ F [50˚ C].

2. Correlated Color Temperature (CCT): 4000K.
3. Color Rendering Index (CRI): ≥ 65.
4. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).

G. Mercury vapor lamps shall not be used.

2.6 HIGH INTENSITY DISCHARGE BALLASTS

A. Per NEMA C82.4 and UL 1029. Ballasts shall be encapsulated or single-lamp, copper-wound, constant-wattage autotransformer type, designed to operate on the voltage system to which they are connected, and capable of open-circuit operation without reducing lamp life.

B. Ballasts shall have individual overcurrent protection in each ungrounded supply conductor.

C. Ballast shall have an allowable line voltage variations of ±10%, with a maximum 20% lamp wattage regulation spread.

D. Power factor shall be not less than 90%.

E. Ballast shall have a minimum starting temperature of -22˚ F [-30˚ C], and a normal ambient operating temperature of 104˚ F [40˚ C].

F. Lamp current crest factor shall be 1.8 or less, in accordance with lamp manufacturer recommendations.

2.7 METAL HALIDE CORE AND COIL BALLASTS

A. Shall be pulse start, linear reactor type for 277 volt luminaires and constant-wattage autotransformer (CWA) type for other voltage luminaires (if not otherwise specified).

B. Ballasts shall have individual overcurrent protection in each ungrounded supply conductor.

C. Power factor shall be not less than 90%.

D. Ballast shall have an allowable line voltage variations of ±5% for linear reactor type and ±10% for CWA, with a maximum 20% lamp wattage regulation spread.

E. Ballast shall have a minimum starting temperature of −40˚ F [-40˚ C].

F. Lamp current crest factor shall be 1.8 or less, in accordance with lamp manufacturer recommendations.

2.8 METAL HALIDE ELECTRONIC BALLASTS

A. Ballast shall be low-frequency electronic type, and shall operate pulse start and ceramic metal halide lamps at a frequency of 90 to 200 Hz square wave.
B. Ballast shall be labeled Type '1' outdoor, suitable for recessed use, Class 'P'.
C. Ballast shall have auto-resetting thermal protector to shut off ballast when operating temperatures reach unacceptable levels.
D. Ballast shall have an end of lamp life detection and shut-down circuit.
E. Lamp current crest factor shall be 1.5 or less.
F. Ballasts shall comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
G. Ballast shall have a minimum ballast factor of 1.0.
H. Input current THD shall not exceed 20% for the primary lamp.
I. Ballasts shall have ANSI C62.41, category 'A' transient protection.
J. Ballasts shall have power factor greater than 90%.
K. Ballast shall have a Class 'A' sound rating.

2.9 LED DRIVERS

A. LED drivers shall meet the following requirements:
   1. Drivers shall have a minimum efficiency of 85%.
   2. Starting Temperature: -40° F [-40° C].
   3. Input Voltage: 120 to 480 (±10%) V.
   4. Power Supplies: Class I or II output.
   5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
   6. Power Factor (PF): ≥ 0.90.
   7. Total Harmonic Distortion (THD): ≤ 20%.
   8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
   9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.10 EXISTING LIGHTING SYSTEMS

A. For modifications or additions to existing lighting systems, the new components shall be compatible with the existing systems.
B. New poles and luminaires shall have approximately the same configurations and dimensions as the existing poles and luminaires, except where otherwise shown on the drawings.

2.11 SERIES LIGHTING SYSTEMS

A. Series-Type Systems:

1. Provide components specifically for constant-current series type lighting systems.
2. Constant-Current Transformers:
   a. Self-cooled by natural convection, liquid-immersed, fully automatic, outdoor type.
   b. Liquid shall be oil, conforming to ASTM D3487, except where otherwise shown.
   c. Temperature rises shall not exceed the following test values for the respective insulation systems:
      1) Standard, 131˚ F [55˚ C] by resistance and 149˚ F [65˚ C] hottest spot.
      2) Thermally upgraded, 149˚ F [65˚ C] by resistance and 180˚ F [80˚ C] hottest spot.
   d. Core Coil Assemblies:
      1) Braced to withstand the stresses caused by the maximum current possible under all conditions and rough handling during shipment.
      2) Cores, silicon steel.
      3) Coils, continuous windings without splices, except for taps.
   e. Bring primary and secondary leads out through wet-process, porcelain bushings, pressure-tight. Terminals shall be suitable for the specific cables being connected to them.
   f. Series-type systems shall have capacitors for power factor improvement. The value of power factor under the percent of full load rating shall be as shown on the drawings.
   g. Series-type systems shall regulate the secondary current within 1% over the entire load rating range while the primary voltage remains within 5% of the rated voltage.
   h. Operation of the transformers shall not be adversely affected while the transformers are mounted five degrees off of perpendicular.
   i. Provide tanks and covers of steel to meet NEMA and ANSI requirements, cleaned, phosphatized, and painted at the factory with primer and the manufacturer's standard extremely durable finish.
   j. Sound levels shall not exceed 45 db.

k. Standard ANSI features and accessories including a pressure relief device, ground pad, lifting provisions, and diagrammatic nameplate.
l. Dimensions and configurations shall conform to the spaces designated for installations.
m. Install the transformers such that they will have adequate air circulation for heat removal.

3. Controllers:
a. Oil-immersed, rated-load-interrupter, outdoor type, with heavy duty, silver-alloy contacts.
b. Oil, ASTM D3487.
c. Operate at 120 V, 60 Hz.
d. Have an auxiliary hand lever for manual operation during emergencies.
e. The depth below the oil surface of the contacts shall be not less than the depth of the switch mechanism.
f. Bring leads out through wet-process, porcelain bushings, pressure-tight. Terminals shall be suitable for the specific cables being connected to them.
g. Provide steel tanks and covers, thoroughly cleaned, phosphatized, and painted at the factory with primer and the manufacturer's standard durable finish.
h. Dimensions and configurations shall conform to the spaces designed for installations.

4. Provide protective relays to de-energize the control circuits for the controllers, thereby de-energizing the series lighting load circuits when open circuit faults occur in the series lighting load circuits.
5. Transformer, equipment enclosure, lightning arresters, and primary and secondary protection shall be provided.
6. Disconnecting devices shall be watertight, submersible type, suitable for the cables being installed and for use in outdoor lighting systems.

2.12 OBSTRUCTION LIGHTING

A. Refer to Section 26 09 23, LIGHTING CONTROLS for control devices.
B. For Buildings:

1. Luminaires shall comply with FAA, AC 70/7460-1K, and AC 150/5345-43E, and be Type L1-810 duplex units with red Fresnel lenses and 100 W, type A-21, clear, traffic-signal lamps.
2. Mount the luminaires on galvanized rigid steel pipe masts attached to the roof of the buildings so the luminaires extend 12 in [305 mm] above the level of the highest item on the building, including items attached to the roof.
3. Locate luminaires in accordance with the applicable FAA Standards.

C. For Smoke Stacks: Luminaires shall be in accordance with the referenced details shown on the drawings. All lamps shall be the type shown on the drawings.

D. For Water Tanks and Cooling Towers: Luminaires shall be FAA, AC 70/7460-1K, and AC 150/5345-43E, Type L-810 duplex units with red Fresnel lenses and 100 W, type A-21, clear, traffic-signal lamps.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer’s recommendations.

B. Pole Foundations:

1. Excavate only as necessary to provide sufficient working clearance for installation of forms and proper use of tamper to the full depth of the excavation. Prevent surface water from flowing into the excavation. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath, and the end of conduit.
2. Set anchor bolts according to anchor-bolt templates furnished by the pole manufacturer.
3. Install poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
4. After the poles have been installed, shimmed, and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 0.375 in [9 mm] inside diameter through the grout, tight to the top of the concrete base to prevent moisture weeping from the interior of the pole.

C. Install lamps in each luminaire.

D. Adjust luminaires that require field adjustment or aiming.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

3.3 ACCEPTANCE CHECKS AND TESTS

Verify operation after installing luminaires and energizing circuits.

3.4 WATER TANKS AND COOLING TOWERS

Mount the luminaires at the extreme top of tank and tower.

- - - E N D - - -

SECTION 31 20 11
EARTHWORK (SHORT FORM)

PART 1 - GENERAL

1.1:DESCRIPTION:

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS:

A. Unsuitable Materials:
   1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
   2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
   3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to Resident Engineer's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in ASTM D698.

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Safety Requirements Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

B. Classified Excavation: Removal and disposal of all material not defined as rock.

C. Rock Excavation:

1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 0.75 m3 (1 cubic yard) capacity, properly used, having adequate power and in good running condition.
3. Boulders or other detached stones each having a volume of 0.4 m3 (1/2 cubic yard) or more.

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities should be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. The measurement will include authorized excavation for rock, authorized excavation of satisfactory subgrade soil, and the volume of loose, scattered rocks and boulders collected within the limits of the work; allowance will be made on the same basis for selected backfill ordered as replacement. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow its, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

1.6 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION:

A. Measurement: Cross section and measure the uncovered and separated materials, and compute quantities by the Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00,

GENERAL REQUIREMENTS. Do not measure quantities beyond the following limits:

1. 300 mm (12 inches) outside of the perimeter of formed footings.
2. 600 mm (24 inches) outside the face of concrete work for which forms are required, except for footings.
3. 150 mm (6 inches) below the bottom of pipe and not more than the pipe diameter plus 600 mm (24 inches) in width for pipe trenches.
4. The outside dimensions of concrete work for which no forms are required (trenches, conduits, and similar items not requiring forms).

B. Payment: No separate payment shall be made for rock excavation quantities shown. The contract price and time will be adjusted for overruns or underruns in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable.

1.7 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Rock Excavation Report:

1. Certification of rock quantities excavated.
2. Excavation method.
3. Labor.
4. Equipment.
5. Land Surveyor's or Civil Engineer's name and official registration stamp.
6. Plot plan showing elevations.

C. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

D. Furnish to Resident Engineer, soil samples, suitable for laboratory tests, of proposed off site or on site fill material.

E. Qualifications of the commercial testing laboratory or Contractor’s Testing facility shall be submitted.

1.8 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Nursery and Landscape Association (ANLA):

2004.....American Standard for Nursery Stock

C. American Association of State Highway and Transportation Officials (AASHTO):

T99-10.....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop

T180-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop

D. American Society for Testing and Materials (ASTM):

C33-03.....Concrete Aggregate

D698-e1.....Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00.....Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

D1556-00.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Laboratory Compaction Characteristics of Soil Using Modified Effort

D2167-94 (2001).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2487-06.....Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)

D6938-10.....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

E. Standard Specifications of //(Insert name of local state)// State Department of Transportation, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m3 (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.

B. Granular Fill:

1. Under concrete slab, granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below. Fine aggregate grading shall conform to ASTM C33 with a maximum of 3 percent by weight passing ASTM D1140, 75 micrometers (No. 200) sieve, or 37.5 mm (1-1/2 inches)and no more than 2 percent by weight passing the 4.75 mm (No. 4) size sieve or coarse aggregate Size 57, 67, or 77.

2. Type I Backfill: Shall be crushed limestone rock having a minimum of two fractured faces and meet the following gradation requirements by dry weight:

SIEVE SIZE	% BY WEIGHT PASSING SIEVE
1″	100
3/4″	90-100
3/8″	20-55
#4	0-10
#8	0-8

C. Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

D. Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

E. Sod: Comparable species with existing turf. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut must be 19 mm to 32 mm (3/4 inch to 1 1/4 inches) excluding top growth. There shall be no broken pads and torn or uneven ends

F. Requirements For Offsite Soils: Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than //100// parts per million (ppm) of total hydrocarbons (TPH) and less than //10// ppm of the sum of Benzene, Toleune, Ethyl Benzene, and Xylene (BTEX)and shall not fail the TCLP test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846.3-3a Method5030/8020. TCLP shall be performed in accordance with EPA SW-846.3-3a Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Material shall not be brought on site until tests have been approved by the Resident Engineer.

G. Buried Warning and Identification Tape: Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specific below for the intended utility with warning and identification imprinted in bold black letters

continuously over the entire tape length. Warning and identification to read, “CAUTION, BURIED (intended service) LINE BELOW” or similar wording. Color and printing shall be permanent, Unaffected by moisture or soil. Warning tape color codes:

Red: Electric or COTR approved color

H. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.076 mm (0.003 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise, and 8.6 MPa (1250 psi) crosswise, with a maximum 350 percent elongation.

I. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastictape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.102 mm (0.004 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise and 8.6 MPa (1250 psi) crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 0.9 m(3 feet) deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

J. Detection Wire For Non-Metallic Piping: Detection wire shall be Insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. System Locates: The Contractor shall be responsible for making arrangements to call for underground locates prior to any clearing or excavation work. Underground utilities including irrigation lines, sprinkler heads and controls disturbed during construction shall be repaired back to the original operating condition.

B. Clearing: Clearing within the limits of earthwork operations as described or designated by the Resident Engineer. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the Medical Center.

C. Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.

D. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from the areas within 4500 mm (15 feet) of new construction and

2250 mm (7’-6”) of utility lines if such removal is approved in advance by the Resident Engineer. Remove materials from the Medical Center. Trees and shrubs, shown to be transplanted, shall be dug with a ball of earth and burlapped in accordance with the latest issue of the, "American Standard for Nursery Stock", of the American Association of Nurserymen, Inc. Transplant trees and shrubs to a permanent or temporary position within two hours after digging. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semi-annually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until the conclusion of the contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in the construction area. Repair immediately damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including the roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Building materials shall not be stored closer to trees and shrubs that are to remain, than the farthest extension of their limbs.

D. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the Resident Engineer. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials, larger than 0.014 m3 (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.

1. NOT USED
2. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be

removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from the Medical Center.

E. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheeting and Bracing: Shore, brace, or slope to it's angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.
   1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.
   2. If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support in compliance with Specification Section 31 23 23.33, FLOWABLE FILL, under disturbed foundations, as directed by Resident Engineer, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by Resident Engineer.

B. Excavation Drainage: Operate pumping equipment, and/or provide other materials, means and equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from Resident Engineer. Approval by the Resident Engineer is also required before placement of the permanent work on all subgrades. When subgrade for foundations has been disturbed by water, remove the disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel. When removed disturbed material is located where it is not possible to install and properly compact disturbed subgrade material with mechanically compacted sand or gravel, the Resident Engineer should be contacted to consider the use of flowable fill.

C. Blasting: Blasting shall not be permitted.

D. Building Earthwork:
   1. Excavation shall be accomplished as required by drawings and specifications.
   2. Excavate foundation excavations to solid undisturbed subgrade.

3. Remove loose or soft material to solid bottom.
4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete, poured separately from the footings.
3. Do not tamp earth for backfilling in footing bottoms, except as specified.

E. NOT USED

F. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are determined by the Resident Engineer as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the Resident Engineer, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments to be based on yardage in cut section only.

G. Finished elevation of subgrade shall be as follows:
1. Pavement Areas - bottom of the pavement or base course as applicable.
2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

3.3 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by Resident Engineer.

B. Proof-rolling Existing Subgrade: Proof-roll with a fully loaded dump truck. Make a minimum of one pass in each direction. Remove unstable uncompactable material and replace with granular fill material completed to mix requirements specified.

C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.

D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized

vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without the prior approval of the Resident Engineer. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer until there is no evidence of further compaction to not less than 95 percent of the maximum density determined in accordance with the following test method ASTM D698. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure.

E. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas by the Contractor at not additional cost to the government.

F. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the Resident Engineer sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.4 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.

B. Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside the building away from the building walls for a minimum distance of 3048 mm (10 feet)at a minimum five percent (5%) slope.

D. The finished grade shall be 150 mm (6 inches) below bottom line of windows or other building wall openings unless greater depth is shown.

E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

F. Finish subgrade in a condition acceptable to the Resident Engineer at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 LAWN AREAS:

A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed must be approved by Resident Engineer before seeding or sodding operation begins.

B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated by broken lines are believed approximately correct but are not guaranteed.

C. Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 12 kg/100 m2 (25 pounds per 1000 square feet).

D. Seeding: Seed at a rate of 2 kg/100 m2 (4 pounds per 1000 square feet) and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller not to exceed 225 kg/m (150 pounds per foot) of roller width.

E. Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom

to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil.

F. Watering: The Resident Engineer is responsible for having adequate water available at the site. As sodding is completed in any one section, the entire sodded area shall be thoroughly irrigated by the contractor, to a sufficient depth, that the underside of the new sod pad and soil, immediately below sod, is thoroughly wet. Resident Engineer will be responsible for sod after installation and acceptance.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

B. Place excess excavated materials suitable for fill and/or backfill on site where directed.

C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

D. Segregate all excavated contaminated soil designated by the Resident Engineer from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN-UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Medical Center Property.

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SECTION 31 23 23.33
FLOWABLE FILL

PART 1 - GENERAL

1.1 INTRODUCTION:

A. Flowable fill refers to a cementitious slurry consisting of a mixture of fine aggregate or filler, water, and cementitious material(s), which is used as a fill or backfill in lieu of compacted earth. This mixture is capable of filling all voids in irregular excavations and hard to reach places (such as under undercuts of existing slabs), is self-leveling, and hardens in a matter of a few hours without the need for compaction in layers. Flowable fill is sometimes referred to as controlled density fill (CDF), controlled low strength material (CLSM), lean concrete slurry, and unshrinkable fill.

B. Flowable fill materials will be used as only as a structural fill replacement on VA projects. The materials and mix design for the flowable fill should be designed to produce a comparable compressive strength to the surrounding soil after hardening, making excavation at a later time possible to produce the compressive strength indicated for the placed location, as determined by the Resident Engineer.

1.2 DESCRIPTION:

Furnish and place flowable fill in a fluid condition that sets within the required time and, after curing, obtains the desired strength properties as evidenced by the laboratory testing of the specific mix design, at locations shown on the plans or as directed by the Resident Engineer, verbally or in writing. This section specifies flowable fill for use as structural fill to remain easily excavatable using a backhoe as would be utilized for adjoining earth.

1.3 RELATED WORK:

A. Earthwork, excavation and backfill and compaction requirements: Section 31 20 11, EARTH MOVING (short form).

1.4 DEFINITIONS:

A. Flowable fill - Ready-mix Controlled Low Strength Material used as an alternative to compacted soil, and is also known as controlled density fill, and several other names, some of which are trademark names of material suppliers. Flowable fill (Controlled Low Strength Material) differs from portland cement concrete as it contains a low cementitious content to reduce strength development for possible future removal. Chemical admixtures may also be used in flowable fill to modify performance properties of strength, flow, set and permeability.

B. Excavatable Flowable fill – flowable fill designed with a compressive strength that will allow excavation as either machine tool excavatable at compressive strength of 1.5 MPa (200 psi) maximum at 1 year, or hand tool excavatable at compressive strength of 0.7 MPa (100 psi) maximum at 1 year.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Flowable Fill Mix Design: Provide flowable fill mix design containing cement and water. At the contractor’s option, it may also contain fly ash, aggregate, or chemical admixtures in any proportions such that the final product meets the strength and flow consistency, and shrinkage requirements included in this specifications.

1. Test and Performance - Submit the following data:

a. Flowable fill shall have a minimum strength of 200 psi according to ASTM C 39 at 28 days after placement.

b. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8 inch per ft.) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall be as measured in Section 10 of ASTM C 940 “Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

c. Flowable fill shall have a unit weight of 115 – 145 lb/feet 3 measured at the point of placement after a 60 minute ready-mix truck ride.

C. Provide documentation that the admixture supplier has experience of at least one year, with the products being provided and any equipment required to obtain desired performance of the product.

D. Manufacturer's Certificates: Provide Resident Engineer with a certification that the materials incorporated in the flowable fill, following achievement of the required strength, do not represent a threat to groundwater quality.

1.6 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

D4832-02.....Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
C618-03.....Standard Specifications for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as Mineral Admixture in Concrete. (Use Fly Ash conforming to the chemical and physical requirements for mineral admixture, Class F listed, including Table 2 (except for Footnote A). Waive the loss on ignition requirement.)
C403/C403M-05.....Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
C150-99 Rev.A-04.....Standard Specification for Portland Cement
C33-03.....Standard Specification for Concrete Aggregates
C494/C494M-04.....Standard Specification for Chemical Admixtures for Concrete
C940 RevA-98.....Standard Specification for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced – Aggregate Concrete in the Laboratory

C. American Concrete Institute (ACI):
SP-150-94.....Controlled Low-Strength Materials

1.7 QUALITY ASSURANCE:

A. Manufacturer: Flowable fill shall be manufactured by a ready-mix concrete producer with a minimum of 1-year experience in the production of similar products.
B. Materials: For each type of material required for the work of this Section, provide primary materials that are the products of one manufacturer. If not otherwise specified here, materials shall comply with recommendations of ACI 229, “Controlled Low Strength Materials.”
C. Pre-Approval Procedures: The use of flowable fill during any part of the project shall be restricted to those incidences where, due to field conditions, the Contractor has made the Resident Engineer aware of the conditions for which he recommends the use of the flowable, and the Resident Engineer has confirmed those conditions and approved the use of the flowable fill, in advance. During the submittal process, the contractor shall prepare and submit various flowable fill mix designs corresponding to required conditions or if the contractor desires to use flowable fill due to economics. Approval for the strength of the flowable fill shall be obtained from the Resident Engineer when the contractor desires, or is required, to use flowable fill at specific location(s) within the project. Prior to commencement of field

operations the contractor shall establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

1.8 DELIVERY, STORAGE, AND HANDLING:

Deliver and handle all products and equipment required, in strict compliance with manufacturer’s recommendations. Protect from damage due to weather, excessive temperatures, and construction operations.

1.9 PROJECT CONDITIONS:

Perform installation of flowable fill only when approved by the Resident Engineer, and when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

PART 2 - PRODUCTS

2.1 MATERIALS:

Provide flowable fill containing, at a minimum, cementitious materials, sand and water. Cementitious materials shall be portland cement, pozzolanic materials, or other self-cementing materials, or combinations thereof, at the contractor’s option, and following approval by the Resident Engineer. The flowable fill mix design may also contain, fine aggregate or filler, and/or chemical admixtures in any proportions such that the final product meets the strength, flow consistency and shrinkage requirements included in this specification, as approved by the Resident Engineer.

A. Portland Cement: ASTM C150, Type 1 or Type 2. Meeting South Dakota State DOT standards.
B. Mixing Water: Fresh, clean, and potable. Meeting THE South Dakota State Department of Transportation Standards for use as mix-water for cast-in-place concrete.
C. Air-Entraining Admixture: ASTM C260.
D. Chemical Admixtures: ASTM C494.
E. Aggregate: ASTM C33.

2.2 FLOWABLE FILL MIXTURE:

A. Mix design shall produce a consistency that will result in a flowable product at the time of placement which does not require manual means to move it into place.
B. Flowable fill shall have a minimum strength of 200 psi according to ASTM C39 at 28 days after placement.
C. Flowable fill shall have minimal subsidence and bleed water shrinkage. Evaporation of bleed water shall not result in shrinkage of more than 10.4 mm per m (1/8-inch per foot) of flowable fill depth (for mixes containing high fly ash content). Measurement of a Final Bleeding shall

be as measured in Section 10 of ASTM C 940 “Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

D. Flowable fill shall have a unit weight of 115 – 145 lbs/feet3 measured at the point of placement after a 60 minute ready-mix truck ride. In the absence of strength data the cementitious content shall be a maximum of 90 kg/m3 (150 lbs/cy).

E. Flowable fill shall have an in-place yield of a maximum of 110% of design yield for removable types at 1 year.

F. Provide equipment as recommended by the Manufacturer and comply with manufacturer’s recommendations for the addition of additives, whether at the production plant or prior to placement at the site.

PART 3 - EXECUTION

3.1 EXAMINATION:

Examine conditions of substrates and other conditions under which work is to be performed and notify Resident Engineer, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 APPLICATION OF FLOWABLE FILL:

Secure tanks, pipes and other members to be encased in flowable fill. Ensure that there are no exposed metallic pipes, conduits, or other items that will be in contact with the flowable fill after placement. If so, replace with non-metallic materials or apply manufacturers recommended coating to protect metallic objects before placing the flowable fill. Replacement or protection of metallic objects is subject to the approval of the Resident Engineer.

3.3 PROTECTION AND CURING:

Protect exposed surfaces of flowable fill from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by Resident Engineer.

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SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section shall cover site work concrete constructed upon the prepared subgrade and in conformance with the lines, grades, thickness, and cross sections shown. Construction shall include the following:

B. Curb, gutter, and combination curb and gutter.

C. Pedestrian Pavement: Walks, grade slabs, lawn mower strips, crossings, wheelchair curb ramps, terraces, steps.

D. Vehicular Pavement: Service courts, and driveways.

E. Equipment Pads: Oxygen storage, transformers, propane tanks.

1.2 RELATED WORK

A. Laboratory and Field Testing Requirements: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subgrade Preparation: Section 31 20 00, EARTH MOVING.

C. Concrete Materials, Quality, Mixing, Design and Other Requirements: Section 03 30 00, CAST-IN-PLACE-CONCRETE.

D. Metal Components of Steps (Nosing and Railing): Section 05 50 00, METAL FABRICATIONS.

1.3 DESIGN REQUIREMENTS

Design all elements with the latest published version of applicable codes.

1.4 WEATHER LIMITATIONS

Placement of concrete shall be as specified under Article 3.8, COLD WEATHER and Article 3.7, HOT WEATHER of Section 03 30 00, CAST-IN-PLACE CONCRETE.

1.5 NOT USED

1.6 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

B. Manufacturers' Certificates and Data certifying that the following materials conform to the requirements specified.

1. Expansion joint filler
2. Hot poured sealing compound
3. Reinforcement
4. Curing materials

C. Data and Test Reports: Select subbase material (aggregate base course)

1. Job-mix formula.

2. Source, gradation, liquid limit, plasticity index, percentage of wear, and other tests as specified and in referenced publications.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Refer to the latest edition of all referenced Standards and codes.

B. American Association of State Highway and Transportation Officials (AASHTO):

M031MM031-07-UL.....Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement (ASTM A615/A615M-09)

M055MM055-09-UL.....Steel Welded Wire Reinforcement, Plain, for Concrete (ASTM A185)

M147-65-UL.....Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses (R 2004)

M148-05-UL.....Liquid Membrane-Forming Compounds for Curing Concrete (ASTM C309)

M171-05-UL.....Sheet Materials for Curing Concrete (ASTM C171)

M182-05-UL.....Burlap Cloth Made from Jute or Kenaf and Cotton Mats

M213-01-UL.....Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Type) (ASTM D1751)

M233-86-UL.....Boiled Linseed Oil Mixer for Treatment of Portland Cement Concrete

T099-09-UL.....Moisture-Density Relations of Soils Using a 2.5 kg. (5.5 lb) Rammer and a 305 mm (12 in.) Drop

T180-09-UL.....Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop

C. American Society for Testing and Materials (ASTM):

C94/C94M-09.....Ready-Mixed Concrete

C143/C143M-09.....Slump of Hydraulic Cement Concrete

SPEC WRITER NOTE: Update materials to agree with requirements (type, grades, class, test method, tables, etc.) specified in the referenced APPLICABLE PUBLICATIONS.

PART 2 - PRODUCTS

2.1 GENERAL

Concrete shall be Type C, air-entrained as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, with the following exceptions:

TYPE	MAXIMUM SLUMP*
Curb & Gutter	75 mm (3")
Pedestrian Pavement	75 mm (3")
Vehicular Pavement	50 mm (2") (Machine Finished) 100 mm (4") (Hand Finished)
Equipment Pad	75 to 100 mm (3" to 4")
* For concrete to be vibrated: Slump as determined by ASTM C143. Tolerances as established by ASTM C94.	

2.2 REINFORCEMENT

A. The type, amount, and locations of steel reinforcement shall be as shown on the drawings and in the specifications.

B. Welded wire-fabric shall conform to AASHTO M55.

C. Dowels shall be plain steel bars conforming to AASHTO M31. Tie bars shall be deformed steel bars conforming to AASHTO M31.

2.3 SELECT SUBBASE (WHERE REQUIRED)

A. Subbase material shall consist of select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials conforming to AASHTO M147, Grading E or F.

B. Materials meeting other gradations than that noted will be acceptable whenever the gradations are within a tolerance of three to five percent, plus or minus, of the single gradation established by the job-mix formula.

C. Subbase material shall produce a compacted, dense-graded course, meeting the density requirement specified herein.

2.4 FORMS

A. Use metal or wood forms that are straight and suitable in cross-section, depth, and strength to resist springing during depositing and consolidating the concrete, for the work involved.

B. Do not use forms if they vary from a straight line more than 3 mm (1/8 inch) in any 3000 mm (ten foot) long section, in either a horizontal or vertical direction.

C. Wood forms should be at least 50 mm (2 inches) thick (nominal). Wood forms shall also be free from warp, twist, loose knots, splits, or other defects. Use approved flexible or curved forms for forming radii.

2.5 CONCRETE CURING MATERIALS

A. Concrete curing materials shall conform to one of the following:

1. Burlap conforming to AASHTO M182 having a weight of 233 grams (seven ounces) or more per square meter (yard) when dry.

2. Impervious Sheeting conforming to AASHTO M171.
3. Liquid Membrane Curing Compound conforming to AASHTO M148 (ASTM C309), Type 1 or Type 2 shall be free of paraffin or petroleum.

2.6 EXPANSION JOINT FILLERS

Material shall conform to AASHTO M213.

PART 3 - EXECUTION

3.1 SUBGRADE PENETRATION

A. Prepare, construct, and finish the subgrade as specified in Section 31 20 00, EARTH MOVING.
B. Maintain the subgrade in a smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE (WHERE REQUIRED)

A. Mixing: Proportion the select subbase by weight or by volume in quantities so that the final approved job-mixed formula gradation, liquid limit, and plasticity index requirements will be met after subbase course has been placed and compacted. Add water in approved quantities, measured by weight or volume, in such a manner to produce a uniform blend.
B. Placing:
   1. Place the mixed material on the prepared subgrade in a uniform layer to the required contour and grades, and to a loose depth not to exceed 200 mm (8 inches), and that when compacted, will produce a layer of the designated thickness.
   2. When the designated compacted thickness exceeds 150 mm (6 inches), place the material in layers of equal thickness. Remove unsatisfactory areas and replace with satisfactory mixture, or mix the material in the area.
   3. In no case will the addition of thin layers of material be added to the top layer in order to meet grade.
   4. If the elevation of the top layer is 13 mm (1/2 inch) or more below the grade, excavate the top layer and replace with new material to a depth of at least 75 mm (3 inches) in compacted thickness.
C. Compaction:
   1. Perform compaction with approved equipment (hand or mechanical) well suited to the material being compacted.
   2. Moisten or aerate the material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used.

3. Compact each layer to at least 95 percent or 100 percent of maximum density as determined by AASHTO T180 or AASHTO T99 respectively.

D. Smoothness Test and Thickness Control:
Test the completed subbase for grade and cross section with a straight edge.
1. The surface of each layer shall not show any deviations in excess of 10 mm (3/8 inch).
2. The completed thickness shall be within 13 mm (1/2 inch) of the thickness as shown.

E. Protection:
1. Maintain the finished subbase in a smooth and compacted condition until the concrete has been placed.
2. When Contractor's subsequent operations or adverse weather disturbs the approved compacted subbase, excavate, and reconstruct it with new material meeting the requirements herein specified, at no additional cost to the VA.

3.3 SETTING FORMS

A. Base Support:
1. Compact the base material under the forms true to grade so that, when set, they will be uniformly supported for their entire length at the grade as shown.
2. Correct imperfections or variations in the base material grade by cutting or filling and compacting.

B. Form Setting:
1. Set forms sufficiently in advance of the placing of the concrete to permit the performance and approval of all operations required with and adjacent to the form lines.
2. Set forms to true line and grade and use stakes, clamps, spreaders, and braces to hold them rigidly in place so that the forms and joints are free from play or movement in any direction.
3. Forms shall conform to line and grade with an allowable tolerance of 3 mm (1/8 inch) when checked with a straightedge and shall not deviate from true line by more than 6 mm (1/4 inch) at any point.
4. Do not remove forms until removal will not result in damaged concrete or at such time to facilitate finishing.
5. Clean and oil forms each time they are used.

C. The Contractor’s Registered Professional Land Surveyor, specified in Section 00 72 00, GENERAL CONDITIONS, shall establish and control the alignment and the grade elevations of the forms or concrete slipforming machine operations.

1. Make necessary corrections to forms immediately before placing concrete.
2. When any form has been disturbed or any subgrade or subbase has become unstable, reset and recheck the form before placing concrete.

3.4 EQUIPMENT

A. The Resident Engineer shall approve equipment and tools necessary for handling materials and performing all parts of the work prior to commencement of work.

B. Maintain equipment and tools in satisfactory working condition at all times.

3.5 PLACING REINFORCEMENT

A. Reinforcement shall be free from dirt, oil, rust, scale or other substances that prevent the bonding of the concrete to the reinforcement.

B. Before the concrete is placed, the Resident Engineer shall approve the reinforcement, which shall be accurately and securely fastened in place with suitable supports and ties. The type, amount, and position of the reinforcement shall be as shown.

3.6 PLACING CONCRETE - GENERAL

A. Obtain approval of the Resident Engineer before placing concrete.

B. Remove debris and other foreign material from between the forms before placing concrete. Obtain approval of the Resident Engineer before placing concrete.

C. Before the concrete is placed, uniformly moisten the subgrade, base, or subbase appropriately, avoiding puddles of water.

D. Convey concrete from mixer to final place of deposit by a method which will prevent segregation or loss of ingredients. Deposit concrete so that it requires as little handling as possible.

E. While being placed, spade or vibrate and compact the concrete with suitable tools to prevent the formation of voids or honeycomb pockets. Vibrate concrete well against forms and along joints. Over-vibration or manipulation causing segregation will not be permitted. Place concrete continuously between joints without bulkheads.

F. Install a construction joint whenever the placing of concrete is suspended for more than 30 minutes and at the end of each day's work.

G. Workmen or construction equipment coated with foreign material shall not be permitted to walk or operate in the concrete during placement and finishing operations.

3.7 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

A. Place concrete in the forms in one layer of such thickness that, when compacted and finished, it will conform to the cross section as shown.
B. Deposit concrete as near to joints as possible without disturbing them but do not dump onto a joint assembly.
C. After the concrete has been placed in the forms, use a strike-off guided by the side forms to bring the surface to the proper section to be compacted.
D. Consolidate the concrete thoroughly by tamping and spading, or with approved mechanical finishing equipment.
E. Finish the surface to grade with a wood or metal float.
F. All Concrete pads and pavements shall be constructed with sufficient slope to drain properly.

3.8 PLACING CONCRETE FOR VEHICULAR PAVEMENT

A. Deposit concrete into the forms as close as possible to its final position.
B. Place concrete rapidly and continuously between construction joints.
C. Strike off concrete and thoroughly consolidate by a finishing machine, vibrating screed, or by hand-finishing.
D. Finish the surface to the elevation and crown as shown.
E. Deposit concrete as near the joints as possible without disturbing them but do not dump onto a joint assembly. Do not place adjacent lanes without approval by the Resident Engineer.

3.9 CONCRETE FINISHING - GENERAL

A. The sequence of operations, unless otherwise indicated, shall be as follows:
    1. Consolidating, floating, straight-edging, troweling, texturing, and edging of joints.
    2. Maintain finishing equipment and tools in a clean and approved condition.

3.10 CONCRETE FINISHING CURB AND GUTTER

A. Round the edges of the gutter and top of the curb with an edging tool to a radius of 6mm (1/4 inch) or as otherwise detailed.
B. Float the surfaces and finish with a smooth wood or metal float until true to grade and section and uniform in textures.
C. Finish the surfaces, while still wet, with a bristle type brush with longitudinal strokes.
D. Immediately after removing the front curb form, rub the face of the curb with a wood or concrete rubbing block and water until blemishes, form

marks, and tool marks have been removed. Brush the surface, while still wet, in the same manner as the gutter and curb top.

E. Except at grade changes or curves, finished surfaces shall not vary more than 3 mm (1/8 inch) for gutter and 6 mm (1/4 inch) for top and face of curb, when tested with a 3000 mm (10 foot) straightedge.

F. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

G. Correct any depressions which will not drain.

H. Visible surfaces and edges of finished curb, gutter, and combination curb and gutter shall be free of blemishes, form marks, and tool marks, and shall be uniform in color, shape, and appearance.

3.11 CONCRETE FINISHING PEDESTRIAN PAVEMENT

A. Walks, Grade Slabs, Lawn Mower Crossings, Wheelchair Curb Ramps, Terraces,:

1. Finish the surfaces to grade and cross section with a metal float, trowled smooth and finished with a broom moistened with clear water.
2. Brooming shall be transverse to the line of traffic.
3. Finish all slab edges, including those at formed joints, carefully with an edger having a radius as shown on the Drawings.
4. Unless otherwise indicated, edge the transverse joints before brooming. The brooming shall eliminate the flat surface left by the surface face of the edger. Execute the brooming so that the corrugation, thus produced, will be uniform in appearance and not more than 2 mm (1/16 inch) in depth.
5. The completed surface shall be uniform in color and free of surface blemishes, form marks, and tool marks. The finished surface of the pavement shall not vary more than 5 mm (3/16 inch) when tested with a 3000 mm (10 foot) straightedge.
6. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).
7. Remove and reconstruct irregularities exceeding the above for the full length between regularly scheduled joints.

B. Steps: The method of finishing the steps and the sidewalls is similar to above except as herein noted.

1. Remove the riser forms one at a time, starting with the top riser.
2. After removing the riser form, rub the face of the riser with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. Use an outside edger to round the corner of the tread; use an inside edger to finish the corner at the bottom of the riser.

3. Give the risers and sidewall a final brush finish. The treads shall have a final finish with a stiff brush to provide a non-slip surface.
4. The texture of the completed steps shall present a neat and uniform appearance and shall not deviate from a straightedge test more than 5 mm (3/16 inch).

3.12 CONCRETE FINISHING FOR VEHICULAR PAVEMENT

A. Accomplish longitudinal floating with a longitudinal float not less than 3000 mm (10 feet) long and 150 mm (6 inches) wide, properly stiffened to prevent flexing and warping. Operate the float from foot bridges in a sawing motion parallel to the direction in which the pavement is being laid from one side of the pavement to the other, and advancing not more than half the length of the float.

B. After the longitudinal floating is completed, but while the concrete is still plastic, eliminate minor irregularities in the pavement surfaces by means of metal floats, 1500 mm (5 feet) in length, and straightedges, 3000 mm (10 feet) in length. Make the final finish with the straightedges, which shall be used to float the entire pavement surface.

C. Test the surface for trueness with a 3000 mm (10 foot) straightedge held in successive positions parallel and at right angles to the direction in which the pavement is being laid and the entire area covered as necessary to detect variations. Advance the straightedge along the pavement in successive stages of not more than one half the length of the straightedge. Correct all irregularities and refinish the surface.

D. The finished surface of the pavement shall not vary more than 6 mm (1/4 inch) in both longitudinal and transverse directions when tested with a 3000 mm (10 foot) straightedge.

E. The thickness of the pavement shall not vary more than 6 mm (1/4 inch).

F. When most of the water glaze or sheen has disappeared and before the concrete becomes nonplastic, give the surface of the pavement a broomed finish with an approved fiber broom not less than 450 mm (18 inches) wide. Pull the broom gently over the surface of the pavement from edge to edge. Brooming shall be transverse to the line of traffic and so executed that the corrugations thus produced will be uniform in character and width, and not more than 3 mm (1/8 inch) in depth. Carefully finish the edge of the pavement along forms and at the joints with an edging tool. The brooming shall eliminate the flat surface left by the surface face of the edger.

G. The finish surfaces of new and existing abutting pavements shall coincide at their juncture.

3.13 CONCRETE FINISHING EQUIPMENT PADS

A. After the surface has been struck off and screeded to the proper elevation, give it a smooth dense float finish, free from depressions or irregularities.

B. Carefully finish all slab edges with an edger having a radius as shown in the Drawings.

C. After removing the forms, rub the faces of the pad with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The finish surface of the pad shall not vary more than 3 mm (1/8 inch) when tested with a 3000 mm (10 foot) straightedge.

D. Correct irregularities exceeding the above.

3.14 JOINTS - GENERAL

A. Place joints, where shown, conforming to the details as shown, and perpendicular to the finished grade of the concrete surface.

B. Joints shall be straight and continuous from edge to edge of the pavement.

3.15 CONTRACTION JOINTS

A. Cut joints to depth as shown with a grooving tool or jointer of a radius as shown or by sawing with a blade producing the required width and depth.

B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to the cross sections of the curb and gutter.

C. Plates shall remain in place until concrete has set sufficiently to hold its shape and shall then be removed.

D. Finish edges of all joints with an edging tool having the radius as shown.

E. Score pedestrian pavement with a standard grooving tool or jointer.

3.16 EXPANSION JOINTS

A. Use a preformed expansion joint filler material of the thickness as shown to form expansion joints.

B. Material shall extend the full depth of concrete, cut and shaped to the cross section as shown, except that top edges of joint filler shall be below the finished concrete surface where shown to allow for sealing.

C. Anchor with approved devices to prevent displacing during placing and finishing operations.

D. Round the edges of joints with an edging tool.

E. Form expansion joints as follows:

1. Without dowels, about structures and features that project through, into, or against any site work concrete construction.

2. Using joint filler of the type, thickness, and width as shown.
3. Installed in such a manner as to form a complete, uniform separation between the structure and the site work concrete item.

3.17 CONSTRUCTION JOINTS

A. Locate longitudinal and transverse construction joints between slabs of vehicular pavement as shown.

B. Place transverse construction joints of the type shown, where indicated and whenever the placing of concrete is suspended for more than 30 minutes.

C. Use a butt-type joint with dowels in curb and gutter if the joint occurs at the location of a planned joint.

D. Use keyed joints with tiebars if the joint occurs in the middle third of the normal curb and gutter joint interval.

3.18 FORM REMOVAL

A. Forms shall remain in place at least 12 hours after the concrete has been placed. Remove forms without injuring the concrete.

B. Do not use bars or heavy tools against the concrete in removing the forms. Promptly repair any concrete found defective after form removal.

3.20 CURING OF CONCRETE

A. Cure concrete by one of the following methods appropriate to the weather conditions and local construction practices, against loss of moisture, and rapid temperature changes for at least seven days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready to install before actual concrete placement begins. Provide protection as necessary to prevent cracking of the pavement due to temperature changes during the curing period. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove and replace the damaged pavement and employ another method of curing as directed by the Resident Engineer.

B. Burlap Mat: Provide a minimum of two layers kept saturated with water for the curing period. Mats shall overlap each other at least 150 mm (6 inches).

C. Impervious Sheeting: Use waterproof paper, polyethylene-coated burlap, or polyethylene sheeting. Polyethylene shall be at lease 0.1 mm (4 mils) in thickness. Wet the entire exposed concrete surface with a fine spray of water and then cover with the sheeting material. Sheets shall overlap each other at least 300 mm (12 inches). Securely anchor sheeting.

D. Liquid Membrane Curing:

1. Apply pigmented membrane-forming curing compound in two coats at right angles to each other at a rate of 5 m^2/L (200 square feet per gallon) for both coats.
2. Do not allow the concrete to dry before the application of the membrane.
3. Cure joints designated to be sealed by inserting moistened paper or fiber rope or covering with waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.
4. Immediately re-spray any area covered with curing compound and damaged during the curing period.

3.21 CLEANING

A. After completion of the curing period:

1. Remove the curing material (other than liquid membrane).
2. Sweep the concrete clean.
3. After removal of all foreign matter from the joints, seal joints as herein specified.
4. Clean the entire concrete of all debris and construction equipment as soon as curing and sealing of joints has been completed.

3.22 PROTECTION

The contractor shall protect the concrete against all damage prior to final acceptance by the Government. Remove concrete containing excessive cracking, fractures, spalling, or other defects and reconstruct the entire section between regularly scheduled joints, when directed by the Resident Engineer, and at no additional cost to the Government. Exclude traffic from vehicular pavement until the concrete is at least seven days old, or for a longer period of time if so directed by the Resident Engineer.

3.23 FINAL CLEAN-UP

Remove all debris, rubbish and excess material from the Station.

- - - E N D - - -

SECTION 32 84 00

PLANTING IRRIGATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies materials and procedures for furnishing and installing a complete automatically-controlled lawn, trees, shrub, and irrigation system, controllers and all other appurtenances necessary to serve specified landscape and plant bed areas.

1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.

B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 00, CAST-IN-PLACE CONCRETE.

C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

E. Plant materials: Section 32 90 00, PLANTING

F. Metering: SECTION 25 10 10, ADVANCED UTILITY METERING SYSTEM.

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves.

B. Drain Piping: Downstream from circuit-piping drain valves.

C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 volts or for remote-control, signaling power-limited circuits.

1.4 ABBREVIATIONS

A. FPT: Female pipe thread

B. HDPE: high-density polyethylene plastic

C. NPT: National pipe thread

D. PTFE: Polytetrafluoroethylene

E. PVC: Polyvinyl chloride plastic

F. WOG: Water, oil and gas

1.5 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Location of sprinklers and specialties on Drawings is approximate. Contractor to make minor adjustments necessary to avoid plantings and obstructions such as signs, utilities and light standards. Provide 100 percent irrigation coverage of areas indicated.

C. Delegated Design: Provide a 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

D. Minimum Working Pressures: The following are maximum pressure requirements for piping, valves and specialties unless otherwise indicated.

1. Irrigation Main Piping: 100 psi (640 kPa)
2. Circuit Piping: 80 psi (520 kPa)

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support pipe to prevent sagging and bending.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Installer Certification:

1. Installer should be an employer of workers that include a certified irrigation designer qualified by The Irrigation Association Professional Class member of the American Society of Irrigation Consultants Professional Technical Class member of the American Society of Irrigation Consultants to perform specified work., and have provided irrigation installations for 2 years.

2. Service provider qualifications shall be maintained and/or trained by the manufacturer to render satisfactory service within 8 hours of service request notification.

C. System Requirements:

1. 100 percent irrigation coverage of specified areas is required. The Contractor shall, at no additional cost to the Government, make minor adjustments necessary to avoid plantings and obstructions such as signs, utilities and light standards and achieve full and complete coverage of irrigated areas without overspray on roadways, sidewalks, window wells, or buildings and to protect trees from close high spray velocity.

1.8 SUBMITTALS

A. Submit product data as one package for each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Submit the proposed irrigation system design signed and sealed by the qualified professional engineer licensed in the State where the project is located and responsible for document preparation.

C. Submit complete detailed irrigation layout covering design of system showing pipe sizes and lengths; fittings; locations; types and sizes of sprinklers; controls; backflow preventers; valves; // drainage pits; // location and mounting details of electrical control equipment // complete wiring diagram showing routes and wire sizes for; power, signal and control wiring details // and connections to water supply main. Do not start work before final shop drawing approval.

D. Provide qualification data for:

1. A qualified irrigation Installer.

2. A qualified service provider, maintained and/or trained by the manufacturer to render satisfactory service within 8 hours of service request notification.

E. Include a zone chart and controller timing schedule showing each irrigation zone and its control valve; and show the time settings for each automatic controller zone.

F. Provide operation and maintenance data for sprinklers, controllers, automatic control valves,and other parts to include in operation and maintenance manuals.

1.9 EXTRA MATERIALS

A. Furnish extra materials, as called out below, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Rotary and Spray Head Sprinklers, Bubblers, and Emitters : 5 percent of amount installed for each type and size indicated, but no fewer than 2 units.
2. Drip-tube system tubing, Soaker Tubes: 5 percent of total length installed for each type and size indicated, but not less than 50 feet (15 m).

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society Of Mechanical Engineers (ASME):

B16.18-2001.....Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2001.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

B16.24-2006.....Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500 and 2500

B18.2.1-2010.....Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

B40.100-2005.....Pressure Gauges and Gauge Attachments

C. American Society Of Sanitary Engineering (ASSE):

1013-2009.....Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers

D. American Society For Testing And Materials (ASTM):

B32-08.....Solder Metal

B61-08.....Steam or Valve Bronze Castings

B62-09.....Composition Bronze or Ounce Metal Castings

B88/B88M-09.....Seamless Copper Water Tube

B813-10.....Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120

D2241-09.....Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)

D2464-06.....Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

D2466-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

D2467-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

D2564-04(2009)e1.....Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

D2609-02(2008).....Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe

D2683-10.....Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing

D2855-96(2010).....Making Solvent Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

D3261-10a.....Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F656-10.....Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings

F771-99(2005).....Polyethylene (PE) Thermoplastic High-Pressure Irrigation Pipeline Systems

E. American Water Works Association (AWWA):

C504-06.....Rubber-Seated Butterfly Valves

C906-07.....Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) Through 63 in. (1600 mm), for Water Distribution and Transmission

F. American Welding Society (AWS):

A5.8/A5.8M:2004.....Filler Metals for Brazing and Braze Welding

G. General Services Administration:

A-A-60005.....Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole

H. Manufacturers Standardization Society (MSS):

SP-70-2006.....Gray Iron Gate Valves, Flanged and Thread Ends

I. National Fire Protection Association (NFPA):

70 2011 Edition.....National Electrical Code

1.11 WARRANTY

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of // one year // two years // from final acceptance. Further, the Contractor will provide all manufacturers' and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 PIPES, TUBES AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Soft copper tube shall be ASTM B88, Type B water tube, annealed temper.

1. Copper Pressure Fittings shall be ASME B16.18 cast-copper-alloy or ASME B16.22 wrought-copper solder-joint fittings
2. Bronze flanges shall be ASME B16.24, Class 150, with solder-joint end.
3. Copper unions shall be cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

C. Hard Copper Tube: ASTM B88, Type L (ASTM B88, Type B), or ASTM B88, Type M (ASTM B88, Type C), water tube, drawn temper.
   1. Copper pressure fittings: ASME B16.22, wrought-copper solder-joint fittings or ASME B16.18, cast-copper-alloy.
   2. Bronze flanges: ASME B16.24, Class 150, with solder-joint end.
   3. Copper unions: Cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

D. PE pipe with controlled ID shall be ASTM F771, PE 3408 compound; SIDR 11.5 or SIDR 15.
   1. Insert fittings for PE pipe: ASTM D2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.

E. PE pressure pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating not less than 200 psi (1380 kPa).
   1. PE butt, heat-fusion fittings shall be ASTM D3261.
   2. PE socket-type fittings shall be ASTM D2683.

F. PVC pipe: ASTM D1785, PVC 1120 compound, Schedule 80.
   1. PVC socket fittings shall be ASTM D, 2464 Schedule 80.
   2. PVC threaded fittings: ASTM D2464, Schedule 80.
   3. Swing joints: Threaded fittings with elastomeric seals that allow 360 degree rotation, and designed for minimum 200 psi (1375 kPa) working pressure, may be used in lieu of standard threaded fittings.
   4. PVC socket unions: Both headpiece and tailpiece shall be PVC with socket ends.

G. PVC Pipe: ASTM D2241, PVC 1120 compound, SDR 21 or SDR 26.
   1. PVC socket fittings: ASTM D2467, Schedule 80.
   2. PVC socket unions: Both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.2 PIPE JOINING MATERIALS

A. Metal, pipe-flange bolts and nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

B. Brazing filler metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

C. Solder filler metals: ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813.

D. Solvent cements for joining PVC piping: ASTM D2564. Include primer according to ASTM F656.

E. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 VALVES

A. Underground Shut-Off Valves: tie into the existing rain bird system

2.4 AUTOMATIC CONTROL EQUIPMENT - INDEPENDENT ELECTRIC CONTROLLER WITH NO FLOW SENSING (FOR SMALL INSTALLATIONS)

A. The electric automatic control system shall consist of one controller which operates individual remote control valves in accordance with timing schedules programmed into the independent unit. The location of the controller is shown on the drawings.

B. The Controller System shall have the following equipment, characteristics and capabilities:

1. A minimum of 4 independent programs.
2. A 7 day calendar, odd/even day or day interval options of 1 to 30 days and a 365 day clock/calendar.
   a. Exclude a day option to allow for the selection of specific day(s) not to water.
3. Station run times of 1 minute to 10 hours in 1 minute increments with a minimum of 16 total start times and start time stacking within each program.
4. Season adjust setting from 10 to 200 percent in 10 percent increments.
5. Weather-resistant, locking metal cabinet with heavy duty internal transformer.
6. Automatic, semi-automatic, manual and timed-manual operation.
7. 10 position programming dial and LCD display.
8. Self-diagnostic circuit breakers that identify and override electrical malfunction of valves.
9. Non-volatile memory to retain power during power failures of any duration and battery backup to maintain accurate time for up to 90 days.
10. Sensor hook-up with sensor override switch on faceplate.
11. Lightning surge protection.

2.5 NOT USED

2.6 SPRINKLER HEADS

A. Sprinkler heads: Heads type and placement shall be submitted to the COTR for approval by the contractor.The type shall be rain bird to match existing. The entire internal assembly including filter screen, to be

capable of removal from the top without removing the sprinkler case from the riser.

B. Rotary pop-up sprinklers: Gear-driven.
   1. Full circle sprinklers shall be dual or tri-nozzle combination type with positive drive by means of a water-driven gear assembly. Sprinkler head to rotate uniformly and to be driven by means of a train of gears. Sprinklers to be equipped with an integral anti-drain valve to be self-closing at pressures of 10 feet (3.0 m) of head or less. Gears and pinions shall be assembled on stainless steel spindles in a water-lubricated sandproof gear case. An inlet screen shall prevent debris from entering the sprinkler and shall be removable with the internal assembly. Sprinklers outer case shall be constructed of corrosion resistant, impact resistant, heavy-duty ABS.
   2. Part circle sprinklers shall be variable arc type as required with same type drive used for full circle heads.

C. Shrub spray head nozzle shall be pop-up or fixed spray type of standard, undersize or oversize configuration as noted on plans. The sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultraviolet resistant plastic. It shall have a heavy duty stainless steel retract spring and a ratcheting system for alignment of the pattern. The sprinkler shall have a soft elastomer pressure-activated co-molded wiper seal for cleaning debris from the pop-up stem. The sprinkler shall have a plastic or brass nozzle with an adjusting screw capable of regulating the radius and flow. The sprinkler shall be capable of housing protective, non-clogging filter screens or pressure compensating screens (PCS) under the nozzle.

D. Drip Emitters shall be of the pressure compensating, permanently assembled type with 1/2 inch (1.25 cm) FPT inlet. Emitters shall be capable of providing 1 GPM (3.8 LPM) at inlet pressures between 15 and 50 psi (105 and 342 kPa).

E. Emitter distribution tubing shall be constructed of UV resistant vinyl material with a 0.22 inch (5.5 mm) O.D. and a 0.16 inch (4 mm) I.D. Tubing shall be manufactured by the same manufacturer as the drip emitters.

2.7 QUICK COUPLERS

A. Quick couplers shall have all parts contained in a two-piece unit and shall consist of a coupler water seal valve assembly and a removable

upper body to allow the spring and key track to be serviced without shut down of the main.

B. Metal parts shall be brass.

C. Lids shall be lockable vinyl covered and have springs for positive closure on key removal.

D. Furnish 2 hose swivels and operating keys for each size coupler to the Contracting Officer’s Representative.

2.8 LOW VOLTAGE CONTROL VALVE WIRE

A. Wire shall be solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Size of wire shall be in accordance with manufacturer's recommendations, never less than No. 14.

2.9 SPLICING MATERIALS: EPOXY WATERPROOF SEALING PACKET. LOW VOLTAGE CONTROLLER CABLE

A. Multi-strand cable, UL-approved for direct burial in ground. Size and type of wire shall be in accordance with manufacturer’s recommendations.

2.10 SLEEVE MATERIAL

A. ASTM D2241, Schedule 40.

SPEC WRITER NOTE: Use non-detectable type at cemeteries only.

2.11 WARNING TAPE

A. Provide standard, 4-Mil polyethylene 3 inch (76 mm) wide tape, // detectable // non-detectable // type blue with black letters (if potable water), or purple with black letters (if reclaimed or untreated well water), and imprinted with “CAUTION BURIED IRRIGATION WATER LINE BELOW”.

2.12 TRACER WIRES

A. Tracer Wires shall be No. 14, Green, Type TW plastic-coated copper tracer wire shall be installed with non-metallic irrigation main lines.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine proposed irrigation areas for compliance with requirements and conditions affecting installation and performance.

B. Set stakes to identify locations of proposed irrigation system. Obtain Contracting Officer’s Representative's approval before excavation.

3.2 PIPE INSTALLATION - GENERAL

A. Layout work as closely as possible to drawings. Swing joints, offsets and all fittings are not shown. Lines are to be in a common trench wherever possible.

B. Install sprinkler lines to avoid heating, ventilating, and air conditioning trenches; electric ducts; storm and sanitary sewer lines; and existing water and gas mains; all of which have the right of way.

C. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any cracked concrete, due to settling, during the warranty period.

D. Do not lay pipe on unstable material, in wet trenches or, in the opinion of Contracting Officer’s Representative, when trench or weather conditions are unsuitable for work.

E. Allow a minimum of 3 inches (80 mm) between parallel pipes in the same trench.

F. Clean the interior portion of pipe and fittings of foreign matter before installation. Securely close open ends of pipe and fittings with caps or plugs to protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

G. The full length of each section of pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.

H. Hold pipe securely in place while joint is being made.

I. Do not work over, or walk on, pipe in trenches until covered by layers of earth, well tamped, in place to a depth of 12 inches (300 mm) over pipe.

SPEC WRITER NOTE: Select one paragraph, ‘connect’ or ‘disconnect’ options appropriate to installation in either cemetery or hospital.

J. Irrigation lines and control wire in cemetery applications shall run at boundaries of graves, through designated utility lanes or beside roadways so that any gravesite may be opened in the future without disruption of the irrigation system.

K. Irrigation lines and control wire shall run through designated utility lanes or beside roadways where possible.

L. Connect new system to existing mains.

M. Concrete thrust blocks shall be installed where the irrigation main changes direction at “L” and “T” locations and where the irrigation main terminates. Pressure tests shall not be made for a period of 36 hours following the completion of pouring of the thrust blocks. Concrete

thrust blocks for supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure.

N. Minimum cover over water mains shall be 30 inches (750 mm). Cover laterals to minimum depth of 24 inches (600 mm).

O. Warning tape shall be continuously placed 12 inches (300 mm) above sprinkler system water mains and laterals.

3.3 PLASTIC PIPE INSTALLATION

A. Plastic pipe shall be snaked in trench at least1 foot per 100 feet (1 meter to 100 meters) to allow for thermal construction and expansion and to reduce strain on connections.

B. Joints

1. Solvent Welded Socket Type: ASTM D2855.
2. Threaded Type: Apply liquid teflon thread lubricant of teflon thread type. After joint is made hand tight (hard), a strap wrench should be used to make up to two additional full turns.
3. Elastomeric Gasket: ASTM F477.

3.4 EMITTER HOSE INSTALLATION

A. Joint: Solvent weld connection.

B. Bushing: Adaptation from PVC Schedule 40 fittings to flex vinyl hose shall be line size by 3/8 inch (10 mm) insert bushings.

3.5 SLEEVE INSTALLATION

A. Furnish and install where pipe and control wires pass under walks, paving, walls, and other similar areas.

B. Sleeves to be twice line size or greater to accommodate retrieval for repair of wiring or piping and shall extend 12 inches (300 mm) beyond edges of paving or construction.

C. Bed sleeves with a minimum of 4 inches (100 mm) of sand backfill above top of pipe in areas where pipe is placed prior to hardscape is installed.

3.6 VALVE INSTALLATION

A. Locations of remote control valves are schematic. Remote control valves shall be grouped wherever possible and aligned at a set dimension back of curb along roads.

B. No valves shall be set under roads, pavement or walks.

C. Clean interior of valves of foreign matter before installation.

D. Pressure control valves installed adjacent to remote control valve shall be housed in the same valve box.
E. Set valve box cover flush with finished grade.
F. Control valves shall never be less than 3 inches (80 mm) below finished grade.

3.7 SPRINKLER AND QUICK COUPLER INSTALLATION

A. Sprinkler heads and quick couplers shall be placed on temporary nipples extending at least 3 inches (80 mm) above finished grade. After turf is established, remove temporary nipples, ensuring that no dirt or foreign matter enters outlet, and install sprinkler heads and quick couplers at ground surface as detailed.
B. Place part circle rotary sprinkler heads no more than 6 inches (150 mm) from edge, of and flush with top of adjacent walks, header boards, curbs, and mowing aprons, or paved areas at time of installation.
C. Install all sprinklers, shrub sprays and quick couplers on swing joints, as detailed on plans.
D. Set shrub heads 8 inches (200 mm) above grade and 1 foot (300 mm) from edge of curb or pavement. Place adjacent to walls. Stake heads prior to backfilling trenches. Support stakes to be parallel to riser.
E. Each sprinkler section shall drain to waste valves placed at lowest elevation points in the system. Waste valves shall discharge to drainage pits composed of three 1 foot (300 mm) long vertical sections of 24 inch (600 mm) diameter sewer pipe placed under the lawn areas. Fill pipe with gravel and cover with 2 inch (50 mm) precast concrete cover before backfilling. Waste valves may also discharge to storm sewers, where available.

3.8 DRIP IRRIGATION SPECIALTY INSTALLATION

A. Install drip tubes with direct-attached emitters on ground.
B. Install manifold emitter systems with tubing to emitters. Plug unused manifold outlets. Install emitters on the ground.
C. Install application pressure regulators and filter units in piping near device being protected, and in control-valve boxes .

3.9 AUTOMATIC IRRIGATION - CONTROL SYSTEM INSTALLATION

1. Connect to existing system

3.10 CONTROL WIRE INSTALLATION

A. Wiring from master controllers to satellites and stub cuts for future extension shall be located in trench with new mains or in separate

trench at back of curb, unless cross-country route is shown. Locate in trench with mains when possible on cross-country routes.

B. Wiring bundles located with piping shall be set with top of the bundle 2 inches (50 mm) below bottom of the pipe. No two wires in any bundle shall be of the same color. Wires shall be bundled, and tied or taped at 15 foot (4.5 m) intervals. A numbered tag shall be provided at each end of a wire, i.e., at valve, at field located controllers and at master controller. The wires at each end of wire to be the same in number and color.

C. Splicing shall be held to a minimum. A pullbox shall be provided at each splice. No splices will be allowed between field located controllers and remote control valves.

D. Provide 12 inch (300 mm) expansion loops in wiring at each wire connection or change in wire direction. Provide 24 inch (600 mm) loop at remote control valves.

E. The power wire(s) for the operation of irrigation system shall not be run in same conduit as the irrigation control wire(s).

3.11 TRACER WIRE INSTALLATION

A. Tracer wire shall be installed on bottom of trench, adjacent to vertical pipe projections, carefully installed to avoid stress from backfilling, and shall be continuous throughout length of pipe with spliced joints soldered and covered with insulation type tape.

B. Tracer wire shall follow main line pipe and branch lines and terminate in yard box with gate valve controlling these main irrigation lines. Provide sufficient length of wire to reach finish grade, bend back end of wire to make a loop and attach a plastic label with designation "Tracer Wire."

C. Record locations of tracer wires and their terminations on project record documents.

3.12 FIELD TEST AND QUALITY CONTROL

A. Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Pressure test lines before joint areas are backfilled. Backfill a minimum of 12 inches (300 mm) over the pipe to maintain pipe stability during test period. Test piping at hydraulic pressure of 150 psi (1025 kPa) for two hours. Maximum loss shall be 0.8

gallons/inch pipe diameter/1,000-feet (3 L/25 mm pipe diameter/300 m). Locate pump at low point in line and apply pressure gradually. Install pressure gage shut-off valve and safety blow-off valve between pressure source and piping. Inspect each joint and repair leaks. Line shall be retested until satisfactory.

2. After testing, flush system with a minimum of 150 percent of operating flow passing through each pipe beginning with larger mains and continuing through smaller mains in sequence. Flush lines before installing sprinkler heads and quick couplers.
3. After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. After electrical circuitry has been energized and final adjustment of the sprinkler heads to permanent level at ground surface is complete, test each sprinkler section by the pan test and visual test to indicate a uniform distribution within any one sprinkler head area and over the entire area. Operate controllers and automatic control valves to demonstrate the complete and successful installation and operation of all equipment.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Any irrigation product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.13 ADJUSTMENTS

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than // 1/2 inch (13 mm) // Insert value // above, finish grade.

SPEC WRITER NOTE: Adjust verbal instructional hours in following paragraph to suit the installation. Hospital equals 8 hours, cemetery equals 16 hours, minimum.

3.14 DEMONSTRATION AND DOCUMENTATION

A. Prior to final acceptance, verbal instructions, for a period of not less than 100 hours, shall be provided to the operating personnel. Provide 2 additional years of software support for one hour each month.

B. Program controller and satellites according to approved irrigation schedule.

C. Follow manufacturer's instructions for installation.

D. Manufacturer of Control Systems shall certify control system is complete, including all related components, and totally operational. Submit certificate to Contracting Officer’s Representative.

E. Maintain and provide a complete set of as built drawings which shall be corrected daily to show changes in locations of all pipe, valves, pumps and related irrigation equipment. Valves shall be shown with dimensions to reference points.

F. Controller Drawings and Zone Chart(s):

1. Prepare in digital format a drawing mapping the location of all valves, lateral lines, and route of the control wires. Identify all valves as to size, station, number and type of irrigation. Digital formatted "as built" drawings must be approved before controller zone charts are prepared.
2. Provide one controller zone chart for each automatic controller showing the area covered by the controller. The chart shall be a reduced drawing of the actual "as built" system and fit the maximum size controller door will allow. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed folded, in a sealed plastic container, inside the controller door.
3. The final irrigation “as built” drawings shall be submitted in digital format with a different color code used to show area of coverage for each station. All drawings and zone charts must be completed and approved prior to final inspection of the irrigation system.

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SECTION 32 90 00
PLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

This work consists of furnishing and installing all planting materials required for landscaping hereinafter specified in locations as shown. New rock mulch beds will be added around buildings. Sod will be installed in demolition areas involving turf removal. Seeding will be required over trenches in existing turf areas.

1.2 EQUIPMENT

Maintain all equipment, tools and machinery while on the project in sufficient quantities and capacity for proper execution of the work.

1.3 RELATED WORK

A. Section 31 20 00, EARTH MOVING, Stripping Topsoil and Stock Piling.
B. Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
C. Section 32 84 00 PLANTING IRRIGATION

1.4 SUBMITTALS

A. Samples: Submit the following samples for approval before work is started:

Inert Mulch	2.3 kg (5 pounds) of each type to be used.

B. Certificates of Conformance or Compliance: Before delivery, notarized certificates attesting that the following materials meet the requirements specified shall be submitted to the Resident Engineer for approval:
   1. Sod
   2. Membranes (weed barrier fabric)
   8. Rock mulch
C. Manufacturer's Literature and Data:
   1. Metal edging
   2. Erosion control materials

1.5 DELIVERY AND STORAGE

A. Delivery:
   1. Notify the Contracting Officer representative of the delivery schedule in advance so the plant material may be inspected upon arrival at the job site. Remove unacceptable plant material from the job site immediately.
   2. During delivery: Protect sod, from drying out and seed from contamination.

B. Storage:

1. Sprinkle sod with water and cover with moist burlap, straw or other approved covering, and protect from exposure to wind and direct sunlight. Covering should permit air circulation to alleviate heat development.

1.6 PLANTING AND TURF INSTALLATION SEASONS AND CONDITIONS

A. Perform operations within the following dates: April 15, 2012 to June15, 2012.

B. No work shall be done when the ground is frozen, snow covered, too wet or in an otherwise unsuitable condition for planting. Special conditions may exist that warrants a variance in the specified planting dates or conditions. Submit a written request to the Resident Engineer stating the special conditions and proposal variance.

1.7 TURF ESTABLISHMENT PERIOD

A. The Establishment Period for turf shall begin immediately after installation, with the approval of the Resident Engineer, and continue until the date that the Government accepts the project or phase for beneficial use and occupancy. During the Turf Establishment Period the Contractor shall:

1. Water all turf to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is the equivalent of 25 mm (1 inch) of absorbed water per week either through natural rainfall or augmented by periodic watering. Apply water at a moderate rate so as not to displace the mulch or flood the plants and turf.
2. Provide the following turf establishment:
   a. Eradicate all weeds. Water, fertilize, overseed, and perform any other operation necessary to promote the growth of grass.
   b. Replant areas void of turf 0.1 m^2 (one square foot) and larger in area.
   c. Mow the new lawn at least three times prior to the final inspection. Begin mowing when grass is 100 mm (4 inches) high. Mow to a 65 mm (2-1/2 inch) height.

1.8 TURF WARRANTY

A. All work shall be in accordance with the terms of the Paragraph, "Warranty" of Section 00 72 00, GENERAL CONDITIONS, including the following supplements:

1. A One Turf Warranty will begin on the date that the Government accepts the project or phase for beneficial use and occupancy. The Contractor shall have completed, located, and installed all turf according to the plans and specifications. All turf is expected to be living and in a healthy condition at the time of final inspection.

2. The Contractor will replace any areas void of turf immediately. A one year warranty for the turf that was replaced, will begin on the day the work is completed.
3. Replacement of relocated plants, that the Contractor did not supply, is not required unless they die from improper handling and care during transplanting. Loss through Contractor negligence requires replacement in kind and size.
4. The Government will reinspect all turf at the end of the One Year Warranty. The Contractor will replace any dead, missing, or defective turf immediately. The Warranty will end on the date of this inspection provided the Contractor has complied with the work required by this specification. The Contractor shall also comply with the following requirements:
   a. Replace dead, missing or defective plant material prior to final inspection.
   b. Complete remedial measures directed by the Resident Engineer to ensure plant and turf survival.
   c. Repair damage caused while making turf replacements.

1.9 APPLICABLE PUBLICATIONS

A. The publications listed below, form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

B. American National Standards Institute (ANSI) Publications:
ANSI Z60.1-04.....Nursery Stock
ANSI Z133.1-06.....Tree Care Operations-Pruning, Trimming, Repairing, Maintaining, and Removing Trees and Cutting Brush- Safety Requirements

C. Hortus Third, A Concise Dictionary of Plants Cultivated in the U.S. and Canada.

D. American Society for Testing and Materials (ASTM) Publications:
C136-06.....Sieve Analysis of Fine and Coarse Aggregates
C516-02.....Vermiculite Loose Fill Thermal Insulation
C549-06.....Perlite Loose Fill Insulation
D977-05.....Emulsified Asphalt (AASTHO M140)
D2028-97 (Rev. 2004)....Cutback Asphalt (Rapid-curing Type)
D2103-05.....Polyethylene Film and Sheeting

E. Turfgrass Producers International:
Turfgrass Sodding.

F. U. S. Department of Agriculture Federal Seed Act.
1998.....Rules and Regulations

PART 2 - PRODUCTS

2.1 GENERAL

All turf material will conform to the varieties specified or shown in the plant list and be true to botanical name as listed in Hortus Third.

2.2 TOPSOIL

A. Topsoil shall be a well-graded soil of good uniform quality. It shall be a natural, friable soil representative of productive soils in the vicinity. Topsoil shall be free of admixture of subsoil, foreign matter, objects larger than 25 mm (one inch) in any dimension, toxic substances, weeds and any material or substances that may be harmful to plant growth and shall have a pH value of not less than 5.0 nor more than 7.5.

B. Obtain material from stockpiles established under Section 31 20 00, EARTH MOVING, subparagraph, Stripping Topsoil, that meet the general requirements as stated above.

C. If sufficient topsoil is not available on the site to meet the depth as specified herein, the Contractor shall furnish additional topsoil. At least 10 days prior to topsoil delivery, notify the Resident Engineer of the source(s) from which topsoil is to be furnished. Obtain topsoil from well drained areas. Additional topsoil shall meet the general requirements as stated above.

2.3 TURF FERTILIZER

Provide turf fertilizer that is commercial grade, free flowing, uniform in composition, and conforms to applicable state and federal regulations. Granular fertilizer shall bear the manufacturer's warranteed statement of analysis.

2.4 MEMBRANES

A. Landscape Fabric shall be a woven needle-punched polypropylene weighing 113 grams per square meter (4.8 oz. per sq. yd.) And a 950 liter per minute flow rate per sq. meter. (90 gal. per minute flow rate per sq. ft.)

2.5 MULCH

A. Mulch shall be free from deleterious materials and shall be stored as to prevent inclusion of foreign material.

B. Inert mulch materials shall be riverbank stone and crushed granite to match existing rock on site rock mulch in front of hospital building 12 will be sourced locally. The ¾-1 inch crushed gravel will be of a size and color to match the existing rock at building 3.

2.6 EROSION CONTROL

A. Erosion control blanket material shall be cellulose fiber blanket bonded to 6 mm (1/4 inch) square plastic net weighing 10 kg/100 m^2 (20 pounds per 1000 square feet) in 1250 mm (50 inch) wide rolls.

2.7 EDGING

Metal edging shall be galvanized steel or aluminum with slots provided for stakes and shall be (3/16 inch) thick by 6 inches deep in standard lengths. Steel edging shall be treated with a rust preventative coating and factory finished in color green . Anchoring stakes shall be of similar material and 16 to 18 inches long and tapered.

2.8 WATER

Water shall not contain elements toxic to plant life. It shall be obtained from irrigation system as specified in Section 01 00 00, GENERAL REQUIREMENTS, paragraph, Temporary Services at no cost to the Contractor.

2.9 SEED

Seed shall be state-certified seed of the latest season's crop and shall be delivered in original sealed packages bearing the producer's warranteed analysis for percentages of mixtures, purity, germination, weed seed content, and inert material. Seed shall be labeled in conformance with U. S. Department of Agriculture rules and regulations under the Federal Seed Act and applicable state seed laws. Seed that has become wet, moldy, or otherwise damaged will not be acceptable. Onsite seed mixing shall be done only in the presence of the Resident Engineer. Seed mixtures shall Poa Pratensis, Kentucky Bluegrass locally sourced.

2.10 SOD

Sod shall be certified sod as classified in the TPI Guideline Specifications to Turfgrass Sodding. The composition of the grass species in the sod shall be as follows: Poa Pratensis, Kentucky blue grass locally sourced.

PART 3 - EXECUTION

3.1 LAYOUT

Stake bed outlines on project site for approval by the Resident Engineer before beds are dug. The Resident Engineer may approve adjustments to mulch edging locations to meet field conditions.

3.2 EXCAVATION FOR MULCH BEDS

A. Prior to excavating for bed, verify the location of any underground utilities. Damage to utility lines will be repaired at the Contractor's expense. Where lawns have been established prior to planting operation,

cover the surrounding turf before excavations are made in a manner that will protect turf areas. Barricade existing trees, shrubbery, and beds that are to be preserved in a manner that will effectively protect them during the project construction.

3.3 MEMBRANE

Install membrane with 6-inches of overlap and anchor with 4-inch sod stakes where indicated on drawings. Clean membrane of dirt and ebris prior to installing rock mulch.

3.4 MULCH

Install rock mulch to an even depth of 3-inches or greater.

3.5 TOP SOIL

After tilling the soil for bonding of topsoil with the subsoil, spread the topsoil evenly to a minimum depth of 2 (inches). Incorporate topsoil at least 2 into the subsoil to avoid soil layering. Do not spread topsoil when frozen or excessively wet or dry. Correct irregularities in finished surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic. Complete lawn work only after areas are brought to finished grade.

3.6 MECHANICAL SEEDING

A. Broadcast seed by approved sowing equipment at the rate of 5 (pounds per 1,000 square feet. Cover seed to an average depth of 6 mm (1/4 inch) by means of manual raking.

B. Immediately after seeding, firm up the entire area with a roller not exceeding 225 kg/m (150 pounds per foot) of roller width. Where seeding is performed with a cultipacker-type seeder or where seed is applied in combination with hydro-mulching, no rolling is required.

C. Immediately after preparing the seeded area, evenly spread an organic mulch of straw by hand or by approved mechanical blowers at the rate of 0.5 kg/m^2 (2 tons per acre). Application shall allow some sunlight to penetrate and air to circulate but also reduce soil and seed erosion and conserve soil moisture.

3.7 SODDING

A. Accomplish sodding in accordance with the ASPA Guideline Specifications for sodding. Lay sod at right angles to slope or the flow of water. On slope areas, start at the bottom of the slope.

B. After completing the sodding operation, blend the edges of the sodded area smoothly into the surrounding area.

3.8 WATERING

Apply water to the turf areas immediately following installation at a rate sufficient to ensure thorough wetting of the soil to a depth of at least 100 mm (4 inches). Supervise watering operation to prevent run-off. Supply all pumps, hoses, pipelines, and sprinkling equipment. Repair all areas damaged by water operations.

3.9 PROTECTION OF TURF AREAS

Immediately after installation of the turf areas, protect against traffic or other use by erecting barricades, as required, and placing approved signs at appropriate intervals until final acceptance.

3.10 EROSION CONTROL MATERIAL

A. Install and maintain erosion control material meeting the requirements of this specification on the designated areas as shown and specified. Prepare, fertilize and vegetate the area(s) to be covered, as specified, before the erosion material is placed. Immediately following the planting operations, lay the material evenly and smoothly and in contact with the soil throughout. Omit the straw mulch from all seeded areas receiving the erosion control material.

B. For waterways, unroll the material in the direction of waterflow. When two or more strips are required to cover a ditch area, they shall overlap at least 100 mm (4 inches). In case a strip is to be spliced lengthwise, the ends of the strips shall overlap at least 150 mm (6 inches) with the upgrade section on top.

C. When using erosion control material on slopes, place the material either horizontally or vertically to the slope with the edges and ends of adjacent strips butted tightly against each other.

D. Staple each strip in three rows (each edge and center with the center row alternately spaced) with staples spaced not more than 1200 mm (4 feet) longitudinally. When using two or more strips side by side on slopes, use a common row of staples on the adjoining strips. Staple all end strips at 300 mm (one foot) intervals at the end. Firmly embed staples in the underlying soil.

E. Maintenance shall consist of repairs made necessary by erosion, wind, or any other cause. Maintain, protect, repair, or replace the erosion control material until the Termination of the Plant and Warranty Period.

3.11 RESTORATION AND CLEAN-UP

Where existing or new turf areas have been damaged or scarred during planting and construction operations, restore disturbed area to their original condition. Keep at least one paved pedestrian access route and one paved vehicular access route to each building clean at all times. In

areas where planting and turf work have been completed, clear the area of all debris, spoil piles, and containers. Clear all other paved areas when work in adjacent areas is completed. Remove all debris, rubbish and excess material from the station.

3.12 ENVIRONMENTAL PROTECTION

All work and Contractor operations shall comply with the requirements of Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

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